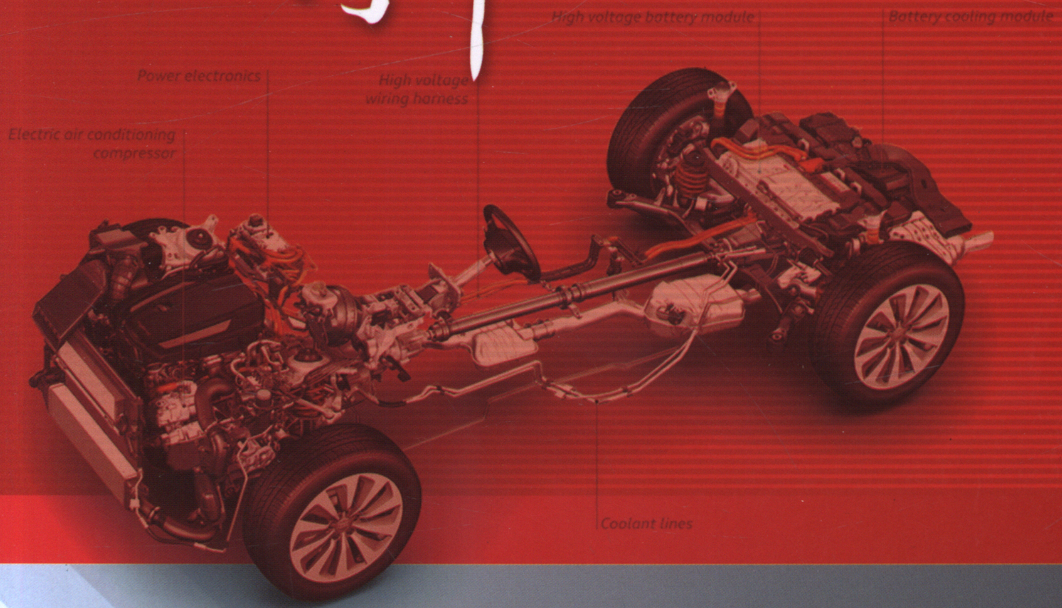
汽车检修一学通丛书

图解汽车维修英语

Vehicle Maintenance

文艳玲 谭克诚◎编


High voltage battery module
Battery cooling module
Power electronics
High voltage wiring harness
Electric air conditioning compressor
Coolant lines

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本书采用图解英语的形式进行编写，每个模块都配有生词解释和练习题，能够帮助读者很好地学习汽车专业英语。书末还附加了目前世界上主流汽车品牌的英文名称及其所属国家，以及汽车标志及其英文名称。

本书分为4大模块，23个单元。内容涵盖了汽车(特别是轿车)大部分系统或总成的工作原理、诊断与维修技术等主题。内容包括：汽车基本组成、汽车分类、汽车车辆识别代码、汽车主要技术参数、发动机基本工作术语、发动机基本构造、发动机的分类、发动机工作原理、电控燃油喷射系统、配气机构、发动机点火系统、发动机起动系统、发动机润滑系统、发动机冷却系统、传动系统、制动系统、转向系统、悬架系统、汽车车身、汽车仪表、汽车空调系统、汽车防抱死制动系统、汽车安全气囊系统、汽车全球定位系统、汽车巡航系统等。

本书图文并茂，内容丰富，适合作为汽车维修专业的专业英语教材，也可作为汽车企业非汽车专业工作人员的汽车英语学习用书，还可以作为汽车维修人员、汽车设计人员的学习用书。

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前 言

近年来，我国的汽车工业迅猛发展，汽车保有量飞速增加。汽车行业与国外的技术交流也日益频繁，汽车维修与服务人员需要阅读大量的英文资料，对其英文水平的要求越来越高。为了适应形势的发展，作者编写了本书。

本书旨在培养汽车专业学生和汽车相关技术人员的英文阅读理解、翻译和资料查询等能力，通过本书的阅读和翻译练习能直接从中获取大量有关汽车方面的信息。

本书实用性强，选材新颖，贴近企业，紧密结合专业，重点突出，针对性强；尤其在练习的编排上，突出了专业英语的特色，设计独特，读者通过练习既能学到英语，又能学到汽车方面的知识，如“识别汽车车标”等，可谓一举两得。

本书分为4大模块，23个单元。内容涵盖了汽车(特别是轿车)大部分系统或总成的工作原理、诊断与维修技术等主题。第1模块内容包括：汽车基本组成、汽车分类、汽车车辆识别代码、汽车主要技术参数与发动机基本工作术语；第2模块内容包括：发动机基本构造、发动机的分类、发动机工作原理、电控燃油喷射系统、配气机构、发动机点火系统、发动机起动系统、发动机润滑系统、发动机冷却系统；第3模块内容包括：传动系统、制动系统、转向系统、悬架系统；第4模块内容包括：汽车车身、汽车仪表、汽车空调系统、汽车防抱死系统、汽车安全气囊系统、汽车全球定位系统、汽车巡航系统。

通过对本书的学习，读者可以进一步巩固已掌握的词汇和语法知识，扩大专业词汇量，熟悉专业英语的表达方式，掌握阅读专业英语的方法，为获取相关的专业信息打下良好的基础。

本书可以作为高职高专汽车类专业的教学用书，也可供具有一定英语基础的汽车工程技术人员和有关的管理人员使用。

本书第1、2模块由文艳玲老师编写，第3、4模块由谭克诚老师编写。在编写本书的过程中，得到了东风柳州汽车有限公司许多科技工作者的大力支持，他们提出了许多汽车技术方面的宝贵意见和建议，编者在此深表谢意。

由于编者水平所限，书中难免出现一些缺点和错误，恳请广大读者批评指正，编者在此表示衷心的感谢。

编 者

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Chapter One Automotive Fundamentals

Unit 1 Basic Structure of Automobile

An automobile is a kind of road vehicle usually with four wheels which is driven by an engine.

In 1886, a Germany engineer, Gottlieb Daimler, invented the first quadric cycle automobile, which means that the car industry came into being. Nowadays the car industry around the world has a tremendous development, and it has been the major estate, especially in the developed countries, which are famous by BMW, Benz and Volkswagen in German, GM, Ford and Chrysler in America, Toyota, Nissan, Mitsbishi and Honda in Japan. With the rapid development of technology, the automobile has become an important symbol of modern science and technology.

Automobiles are the same in structure, although they are quite different in style and design. In other words, any automobile is composed of four sections, such as engine, chassis, body and electrical system (Fig. 1-1-1).

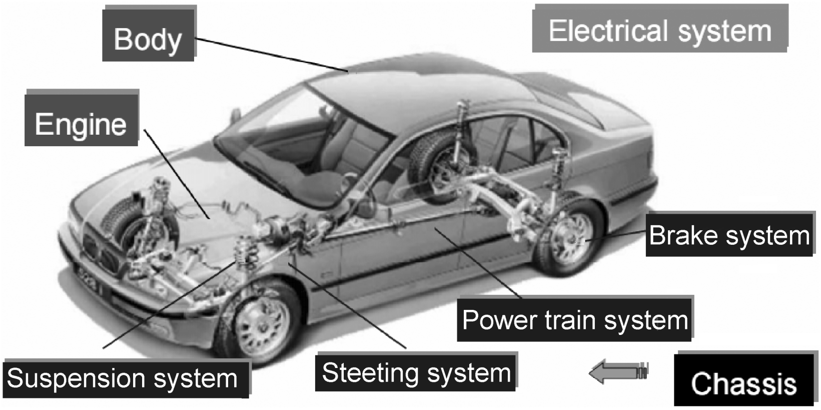


Fig. 1-1-1 Layout of an automobile

1. Engine

The engine is the heart of an automobile. The function of an automotive engine is to convert fuel into energy that moves the automobile. Currently the easiest way to create motion from fuel is to burn the fuel inside an engine. Therefore, an automotive engine is an internal combustion engine, which burns fuel within the cylinders and converts the expanding force of the combustion into rotary force used to drive the automobile. See Fig. 1-1-2.

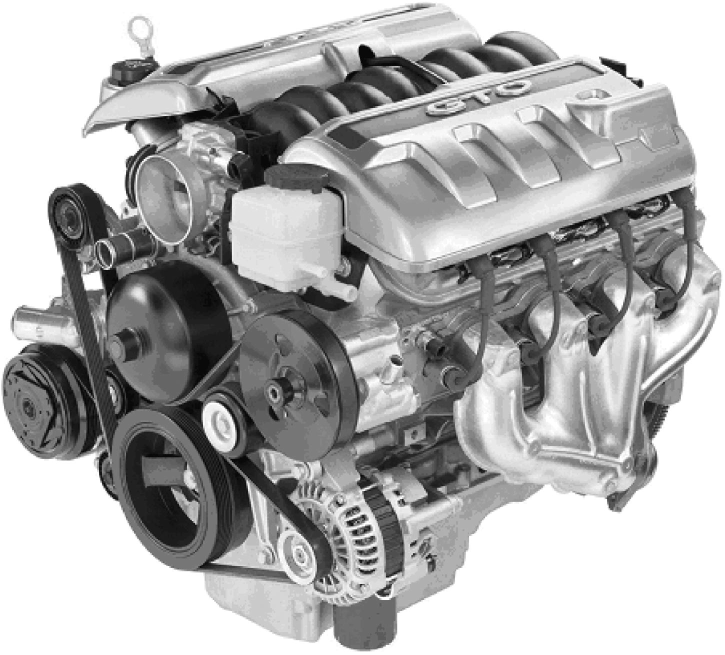


Fig. 1-1-2 Engine

2. Chassis

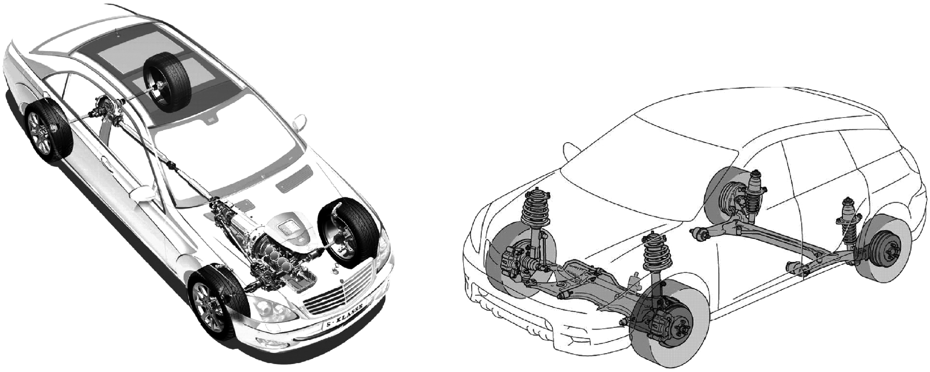
The chassis consists of the power train or transmission system, the suspension system, the steering system and the brake system. The function of the chassis is receiving the power of the engine and making the car move normally. See Fig. 1-1-3.

3. Body

The body is equipped on the chassis. It severs the obvious purpose of holding the driver, passengers and goods, providing shelter, comfort and protection for the occupants. The body provides three-quarters of the vehicle's total rigidity in bending and in torsion. In the case of collision, it is intended to resist and minimize intrusions into the occupant space. The body is designed to keep passengers safe and comfortable. The body styling provides an attractive, colorful, modern appearance for the vehicle.

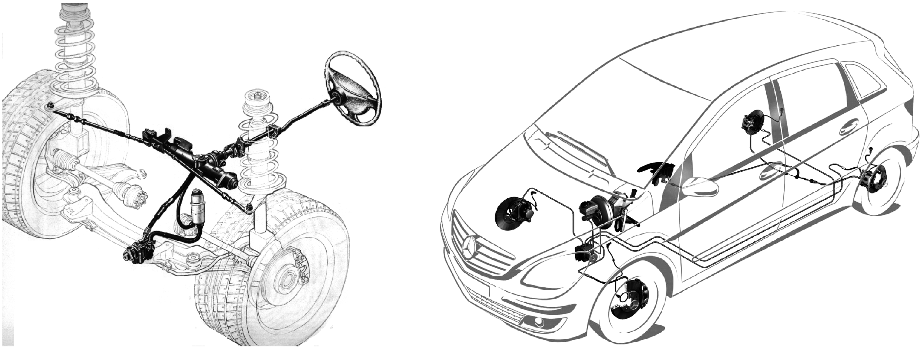
4. Electrical Equipment

The electrical equipment consists of power and electrical equipment. The power equipment consists of batter and generator. The electrical equipment consists of starting



The power train or transmission system

The suspension system



The steering system

The brake system

Fig. 1-1-3 Chassis assembly map

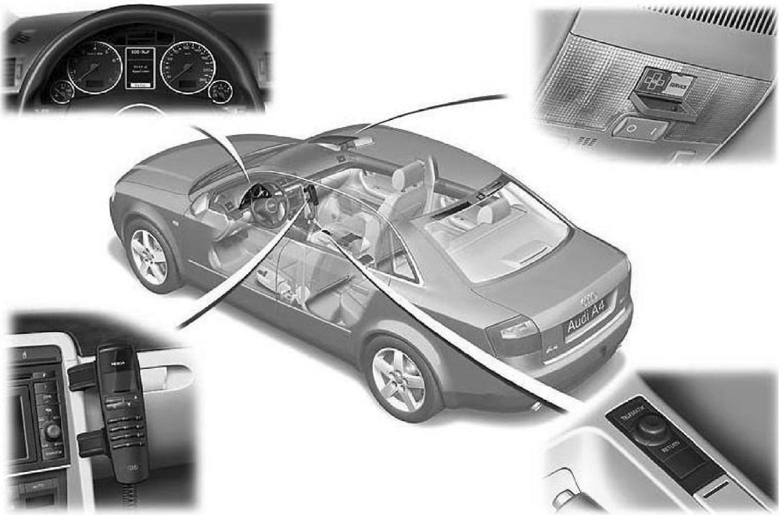


Fig. 1-1-4 Electrical equipment

system, ignition system, lighting system, horn system, instrumentation, air conditioner, audio, wiper and other devices. See Fig. 1-1-4.

New Words and Expressions

automobile	n.	汽车
engine	n.	发动机
structure	n.	构造
chassis	n.	底盘
electrical	adj.	电的
rotary	adj.	旋转的
transmission	n.	变速器，传动装置
shelter	n. /v.	保护，庇护
occupant	n.	乘员
ignition	n.	点燃，点火
suspension	n.	悬架
equipment	n.	设备
battery	n.	蓄电池
generator	n.	发电机
obvious	adj.	明显的
protection	n.	保护

internal combustion engine	内燃(发动)机
air conditioner	空调
consist of	由……组成
power train	传动系统
transmission system	传动系统
suspension system	悬架系统
brake system	制动系统
steering system	转向系统
occupant space	承载空间

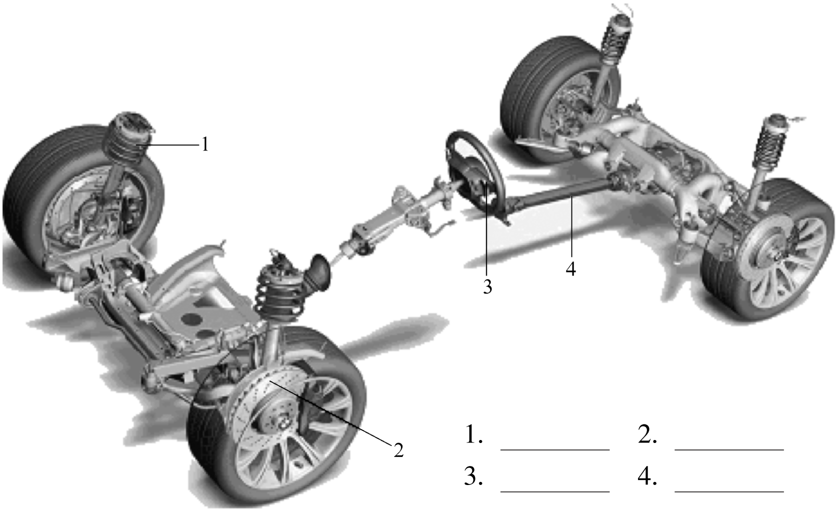
Exercises

Ⅰ. Answer the following questions according to the text.

1. What are the four basic sections of an automobile?
2. What's the function of the engine?

3. How many systems does the chassis include?
4. What's the function of the body?

Ⅱ. Write out the terms according to the picture.



1. ________ 2. ________
3. ________ 4. ________

Ⅲ. Translate the following paragraph into Chinese.

The engine is the heart of an automobile. The function of an automotive engine is to convert fuel into energy that moves the automobile. Currently the easiest way to create motion from fuel is to burn the fuel inside an engine. Therefore, an automotive engine is an internal combustion engine, which burns fuel within the cylinders and converts the expanding force of the combustion into rotary force used to drive the automobile.

Ⅳ. Translate the following sentences into English.

1. 虽然汽车在设计方面有所不同，但在构造上是基本相同的。
2. 底盘包括传动系统、悬架系统、转向系统和制动系统。
3. 任何汽车都是由四部分组成的，如发动机、底盘、车身以及电气系统。
4. 发动机的类型有多种，但最常见的是内燃机。

Unit 2 The Automobile Classification

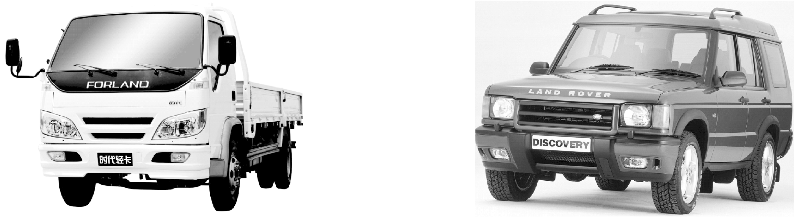
The automobile can be classified according to vehicle types, the engine pistons and drive types, drive power types and vehicle body types.

1. Classified by Vehicle Types

According to vehicle types, cars can be classified into sedan, coach, truck, and so on. See Fig. 1-2-1.

a) Sedan

b) Coach

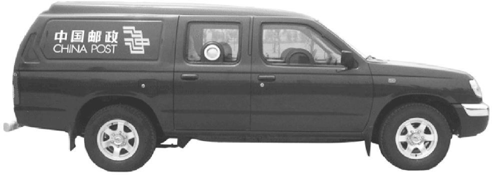


c) Truck

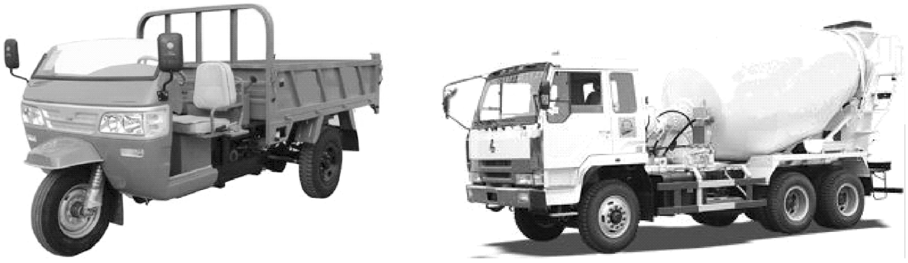
d) Off-road vehicle

e) Right-hand drive truck

f) Dump truck



g) Stock car



h) Agriculture vehicle

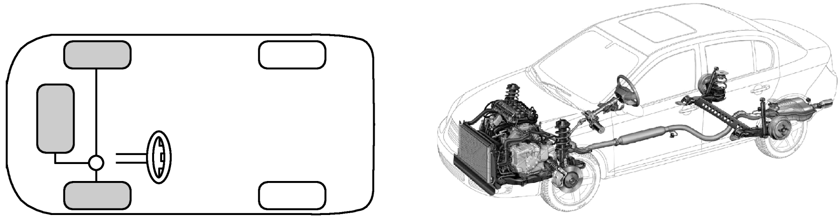
i) Special vehicle

Fig. 1-2-1　Classified by vehicle types

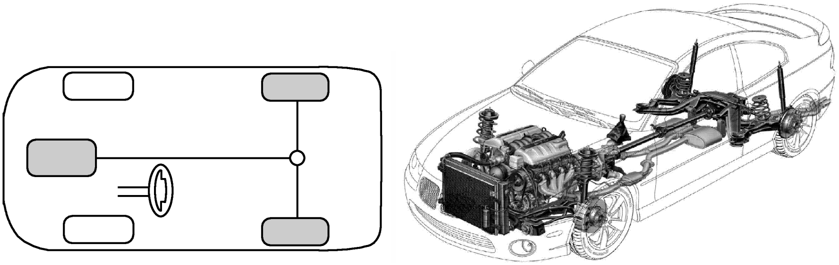
2. Classified by the Engine Pistons and Drive Types

According to the engine pistons and drive types, cars can be classified into front

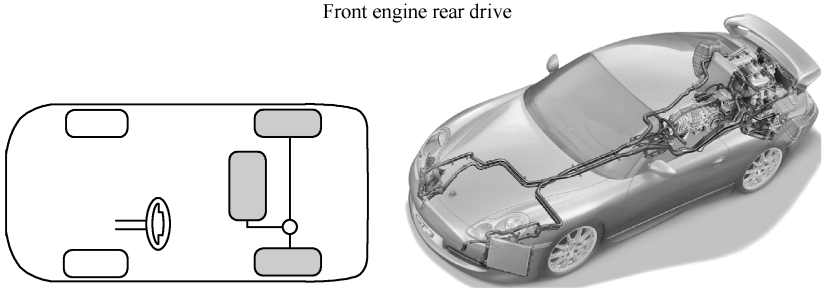
engine front drive(FF), front engine rear drive(FR), rear engine rear drive(RR), middle engine rear drive(MR)and full wheel drive(nWD). See Fig. 1-2-2.



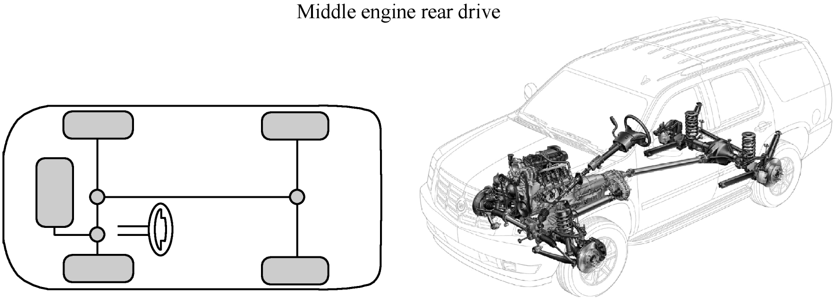
Front engine front drive



Front engine rear drive



Middle engine rear drive



Full wheel drive

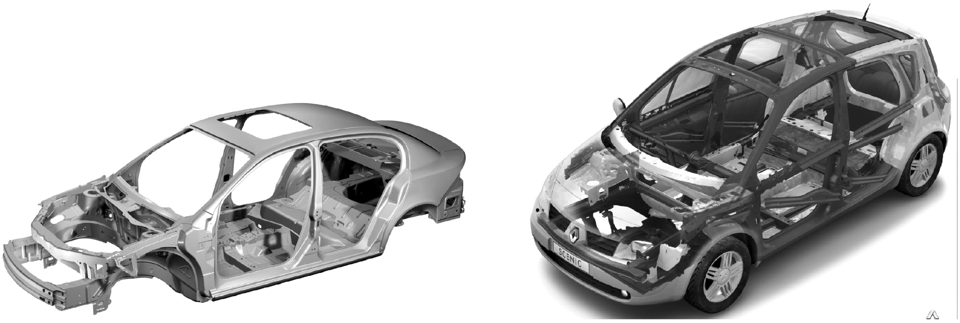
Fig. 1-2-2 Classified by the engine pistons and drive types

3. Classified by the Drive Power Types

According to the drive power types, cars can be classified into gasoline engine vehicle, diesel engine vehicle, mix power vehicle, electric vehicle and fuel battery vehicle.

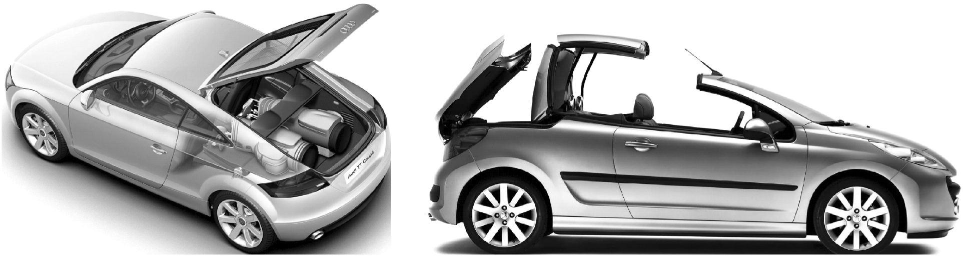
4. Classified by Vehicle Body Types

According to vehicle body types, cars can be classified into three-box, two box, coupe and convertible sedan. See Fig. 1-2-3.



Three-box

Two-box



Coupe

Convertible sedan

Fig. 1-2-3 Classified by vehicle body types

New Words and Expressions

classify	v.	分类
vehicle	n.	车辆
sedan	n.	私家轿车，轿车
fuel	n.	燃料
gasoline	n.	汽油
wheel	n.	车轮
agriculture	n.	农学，农业
tractor	n.	拖拉机，牵引机

off-road vehicle	越野车
front engine front drive(FF)	前置发动机前轮驱动
front engine rear drive(FR)	前置发动机后轮驱动
middle engine rear drive(MR)	中置发动机后轮驱动

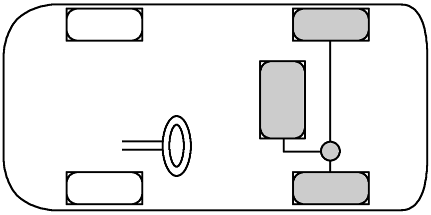
rear engine rear drive(RR)	后置发动机后轮驱动
full wheel drive(nWD)	四轮驱动
dump truck	自卸车
gasoline engine	汽油发动机
diesel engine	柴油发动机
electric vehicle	电动车辆

Exercises

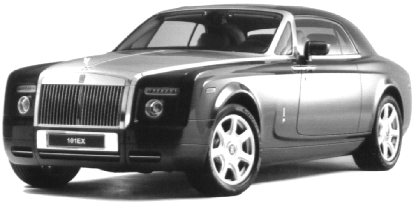
Ⅰ. Answer the following questions according to the text.

1. What types can we classify according to the engine pistons and drive types?
2. What types can we classify according to the vehicle body types?
3. What does FF stand for?
4. What does FR stand for?

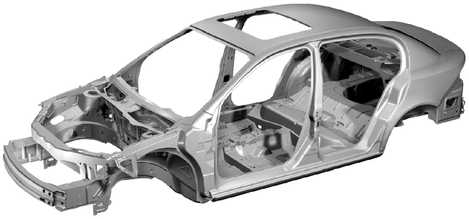
Ⅱ. Write out the terms according to the picture.



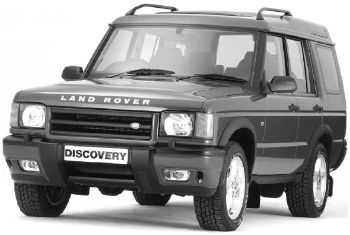
1. ________



2. ________



3. ________



4. ________

Ⅲ. Translate the following paragraph into Chinese.

1. According to the engine pistons and drive types, cars can be classified into front engine front drive(FF), front engine rear drive(FR), rear engine rear drive (RR), middle engine rear drive(MR)and full wheel drive(nWD).

2. According to the drive power types, cars can be classified into gasoline engine vehicle, diesel engine vehicle, mix power vehicle, electric vehicle and fuel battery vehicle.

Unit 3 The Vehicle Technical Parameters

On the vehicle, there is a name plate to show the date of MFD, the plant, the engine, the chassis model, the transaxle, the manufacture shown above, the color trim, the gross vehicle weight rating(GVWR), the vehicle capacity, the size of tyre, the tyre pressure and so on.

Now let's look at the diagrams of this unit.

1. The Key Dimension Data of a Vehicle(Fig. 1-3-1)

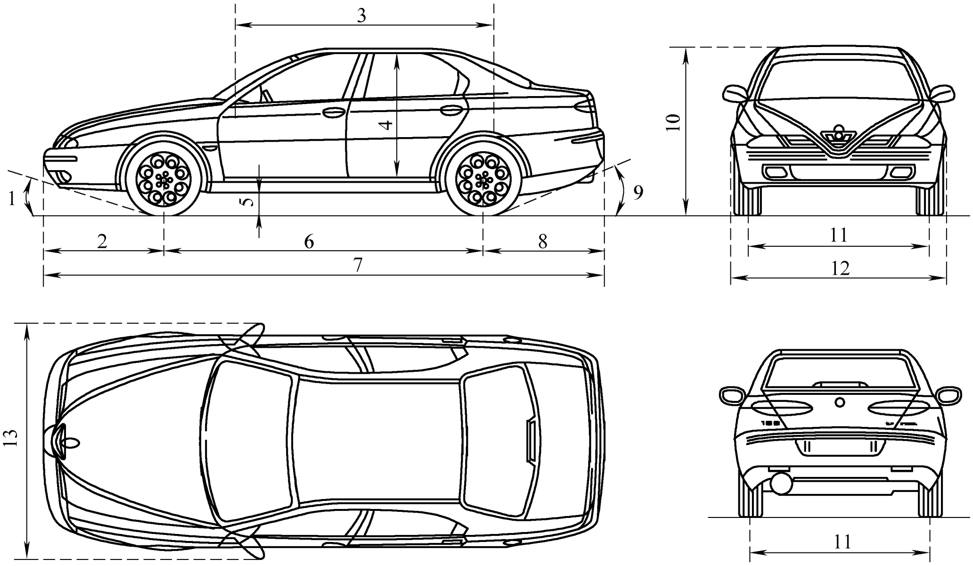


Fig. 1-3-1 The key dimension data of a vehicle

1—approach angle 2—front overhang 3—length of body 4—height of body

5—ground clearance 6—wheel base 7—overall length 8—rear overhang

9—departure angle 10—vehicle height 11—wheel tread

12—width of body 13—vehicle width

2. Engine Terms(Fig. 1-3-2)

(1) Top Dead Center(TDC)

The position of the crank and piston when the piston is farthest away from the crankshaft.

(2) Bottom Dead Center(BDC)

The position of the crank and piston when the piston is nearest away from the crankshaft.

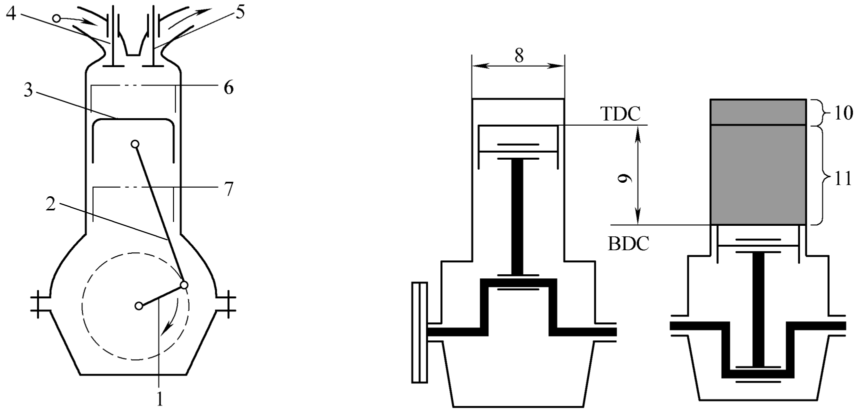


Fig. 1-3-2 Engine terms

1—crankshaft 2—connecting rod 3—piston 4—intake valve

5—exhaust valve 6—TDC 7—BDC 8—bore

9—piston stroke 10—clearance volume 11—swept volume

(3) Swept Volume

The volume between TDC and BDC.

(4) Clearance Volume

The volume of space above the piston when it is at TDC.

(5) Engine Capacity

This is the swept volume of all cylinders. Generally speaking, the larger the engine capacity is, the higher the engine power is.

(6) Compression Ratio

It means that the piston compresses the gas mixture which is made from air and fuel(swept vol. + clearance vol.)/(clearance vol.).

(7) Engine Torque

It means the ability of turning the live axle.

(8) Specific Fuel Consumption

It means the fuel consumption in the given distance.

(9) Engine Power

It means the output of the engine in the given time. The unit of measurement is kW.

3. Vehicle Labeling

Each vehicle has labels which tell us the date and plant of the vehicle manufacture, type(model), engine number, chassis No. , trans or axle number, frame number, color, trim, GVWR, GAWR, tire size, tire pressure, and so on. These are very important for the vehicle to be used and serviced(Shown in Fig. 1-3-3).

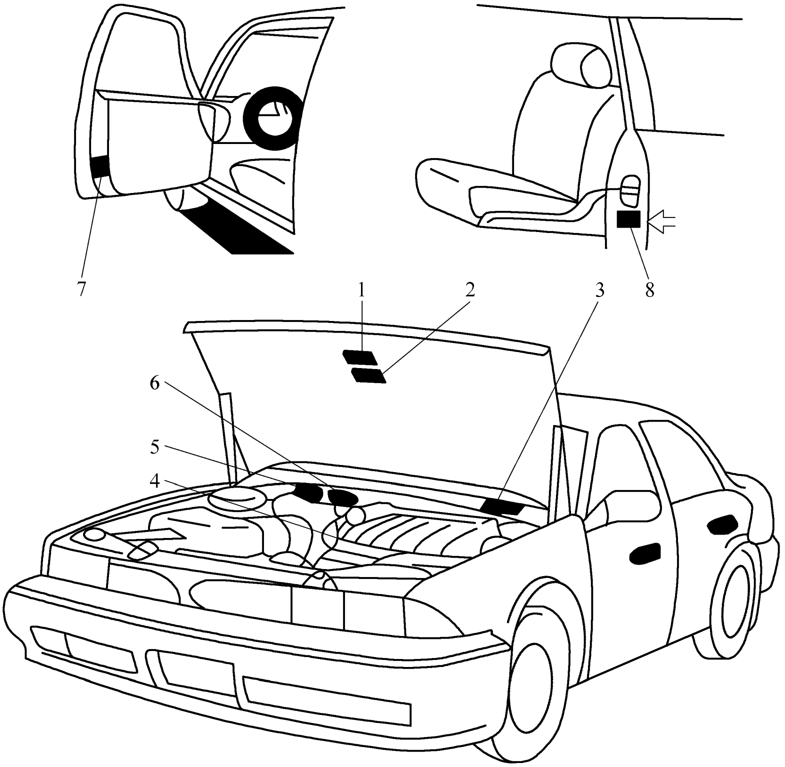


Fig. 1-3-3 Vehicle labeling location

1—vehicle emission control information label 2—service points label

3—vehicle identification number(VIN) plate 4—engine serial number

5—chassis number 6—vehicle information code plate

7—tire inflation pressure label 8—certification label

The followings are some manufacturers' vehicle label. See Fig. 1-3-4 and Fig. 1-3-5.

HONDA Label

MAF in Japan by HONDA MOTOR CO., LTD 9/1993

GVWR 1820kg GAWR F 995kg R 840kg

The vehicle conforms to all applicable federal motor vehicle safety standards in effect on the date of its manufacture.

VIN: JHMCD 5656 RC 803309

Passenger car

TOYOTA Label

TOYOTA MOTOR CORPORATION JAPAN

MODEL	MSl22L-SEMGS
ENGINE	5M
FRAME NO.	MSl22-038994
COLOR 202	TRIM JW31

TRANS/AXLE W55 F312

PLANT A21

NISSAN Label

NISSAN MOTOR CO LTD JAPAN

TYPE	E-RUl2
CHASSIS NO.	RUl2-024096
MODEL	KRUl 2 NAERGJ
COLOR TRIM	DGl G
ENGINE	CAl8(DE) 1809
TRANS AXLE	RL4F02A FH44

FORD Label

LMFD BY FORD MOTOR CO. IN U. S. A.

DATE：	12/1994
GVWR：	5417LB/2457KG
FRONT GAWR：	2588LB 1173 KG
REAR GAWR：	2873LB 1303KG
VIN：	ILNLM81WXSY664549
TYPE：	U S. LERT VOID. EXPORT

EXTERIOR PAINT COLRS

BODY BA4 INT TRIM BJ

BMW 735i Label

735i VEHICLE TYPE PASSENGER CAR

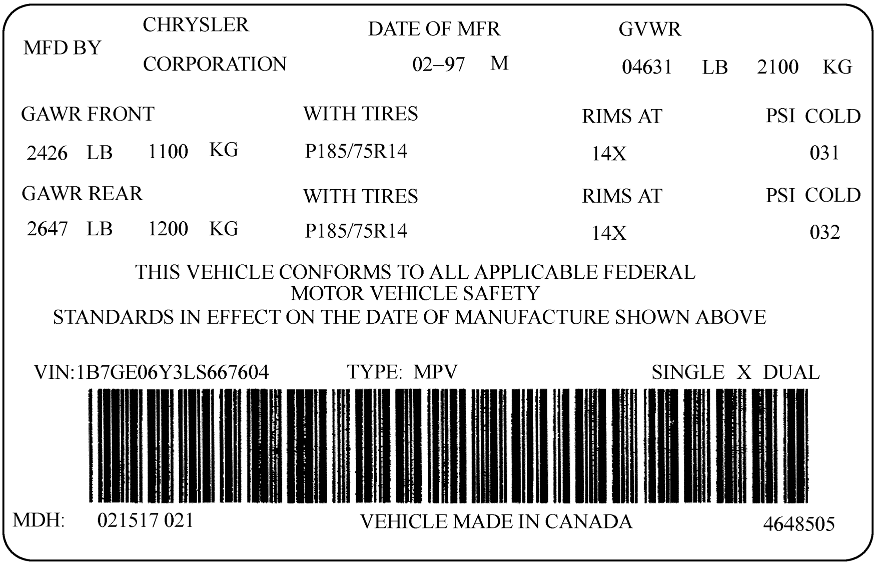
MFD BY BAYERISCHE MOTOREN WERKE AG 02/87

GVWR	4872 lbs	2210 kg
GAWR FRONT	2337 lbs	1060 kg
GAWR REAR	2646 lbs	1200 kg

This vehicle conforms to all applicable U. S. FEDERAL MOTOR VEHICLE SAFETY, BUMPER AND THEFT PREVENTION STANDARDS in effect on the date of manufacture shown above.

VIN WBA GB 3310J1630107

MADE IN GERMANY 2121647



MFD BY	CHRYSLER CORPORATION	DATE OF MFR 02–97 M	GVWR 04631 LB 2100 KG
GAWR FRONT 2426 LB 1100 KG	WITH TIRES P185/75R14	RIMS AT 14X	PSI COLD 031
GAWR REAR 2647 LB 1200 KG	WITH TIRES P185/75R14	RIMS AT 14X	PSI COLD 032

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL
MOTOR VEHICLE SAFETY
STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE

VIN:1B7GE06Y3LS667604 TYPE: MPV SINGLE X DUAL

MDH: 021517 021 VEHICLE MADE IN CANADA 4648505

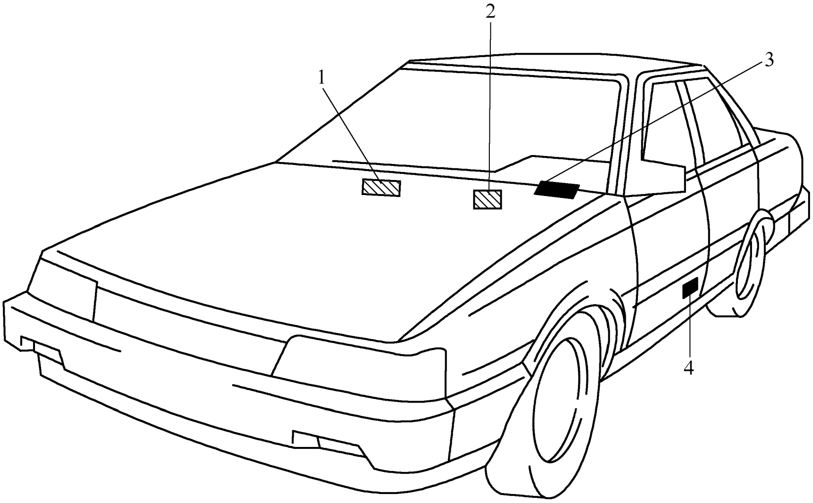


Fig. 1-3-4 2000 Toyota car labels and nameplate mount position

1—vehicle identification number 2—manufacturer plate

3—vehicle identification number plate 4—certification regulation plate

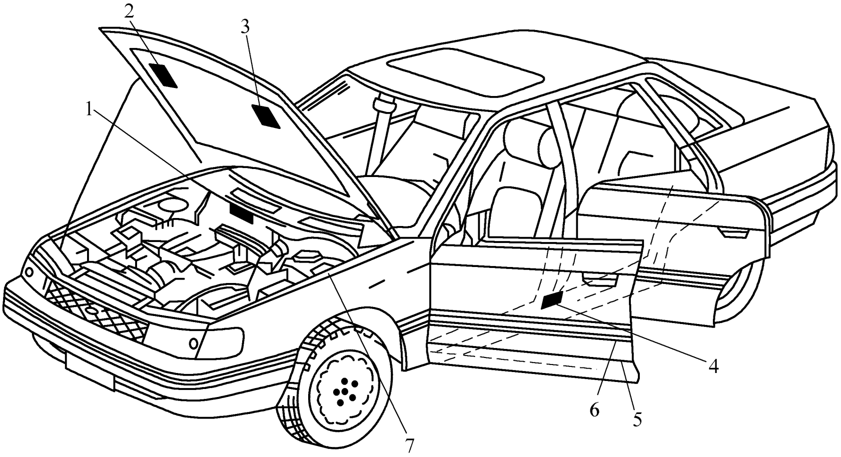


Fig. 1-3-5 2000 Fuji car labels and nameplate mount position

1—chassis number 2—emission control label 3—vacuum hose routing label
4—safety certification label 5—tire information label 6—bar code label 7—model number plate

Expressions

name plate	铭牌
top dead center(TDC)	上止点
bottom dead center(BDC)	下止点
swept volume	有效容积，工作容积
clearance volume	燃烧室容积
engine capacity	发动机排量
compression ratio	压缩比
engine torque	发动机转矩
specific fuel consumption	燃油消耗率
engine power	发动机功率
approach angle	接近角
wheel tread	轮距
wheel base	轴距
ground clearance	离地间隙

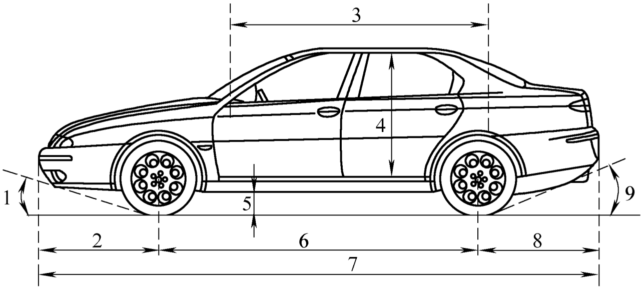
Exercises

Ⅰ. Answer the following questions according to the text.

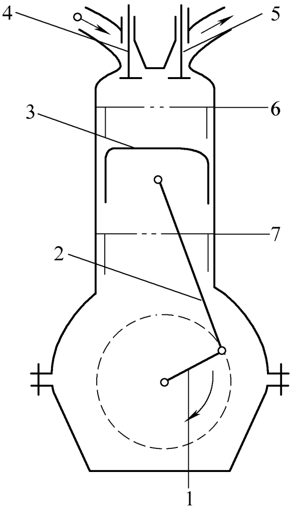
1. What does compression ratio mean?

2. What does TDC stand for?
3. What does engine capacity mean?
4. What does BDC stand for?

Ⅱ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________ 5. ________
6. ________ 7. ________ 8. ________ 9. ________



1. ________ 2. ________ 3. ________ 4. ________
5. ________ 6. ________ 7. ________

Ⅲ. Translate the following paragraph into Chinese.

BMW 735i Label

735i VEHICLE TYPE PASSENGER CAR

MFD BY BAYERISCHE MOTOREN WERKE AG 02/87

GVWR	4872 lbs	2210 kg
GAWR FRONT	2337 lbs	1060 kg
GAWR REAR	2646 lbs	1200 kg

This vehicle conforms to all applicable U. S. FEDERAL MOTOR VEHICLE SAFETY, BUMPER AND THEFT PREVENTION STANDARDS in effect on the date of manufacture shown above.

VIN	WBA GB	3310J1630107
MADE IN GERMANY	2121647	

Chapter Two Engine

Unit 1 Engine Construction

The engine is the source of power that makes the wheels rotate and the car move. The automobile engine is an internal combustion engine because the fuel (gasoline) is burned inside it. The burning of gasoline inside the engine produces high pressure in the engine combustion chamber. This high pressure forces piston to move, the movement is carried by connecting rods to the engine crankshaft. Thus, the crankshaft is made to rotate: the rotary motion is carried through the power train to the car wheels so that they rotate and the car moves.

The engine requires five systems. They are fuel system, cooling system, lubrication system, ignition system and starting system. These five systems are discussed briefly in the following units. The overall structure of an engine is as follows. See Fig. 2-1-1.

The complete engine assembly consists of the mechanical components that make up the engine itself and also a number of associated systems. These are the systems that are needed to start the engine and also to control it and keep it running. The mechanical parts of the engine assembly can be broken down into a number of sub-assemblies, or group of associated components, although these are usually referred to merely as assemblies, for example, cylinder-head assembly and piston assembly. Some parts of an engine are internal, other parts are external—this illustration identifies a number of external parts.

1. Cylinder Block

The engine block is the main supporting structure to which all other engine parts are attached. Fig. 2-1-2 shows a cylinder block. It has two main sections: the cylinder section and the crankcase section. The crankcase section is used to house the crankshaft, oil pan. Cooling passageways are built within the block. These passageways, also known as water sockets, surround the cylinders. They allow coolant to circulate throughout the cylinder area to keep the engine cool. There is also a drilled passageway within some blocks for the camshaft. Many oil holes are drilled internally so that engine parts can be adequately lubricated. See Fig 2-1-2.

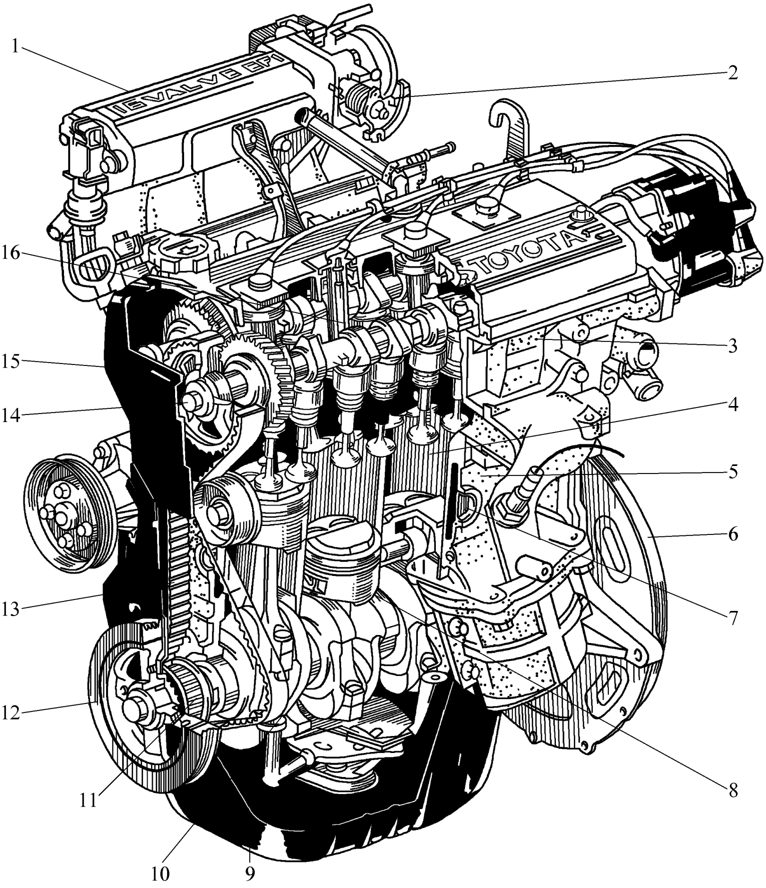


Fig. 2-1-1 The overall structure of an engine

1—intake air tank 2—throttle valve 3—cylinder head 4—cylinder 5—cylinder block
6—flywheel 7—cylinder jacket 8—piston 9—oil pan 10—crankshaft
11—timing belt pulley 12—crankshaft pulley 13—timing belt
14—camshaft 15—timing belt cover 16—spark plug

2. Cylinder Head

The cylinder head is used to hold the valves, and it has ports to allow air, fuel and exhaust to move through the engine. In addition, it has coolant passages. Fig. 2-1-3 shows a cylinder head. After the cylinder head has been cast, some areas must be machined so that intake and exhaust manifolds can be attached, valves can be seated, spark plugs and injectors can be installed, and a good seal can be provided to the block. See Fig. 2-1-3 and Fig. 2-1-4.

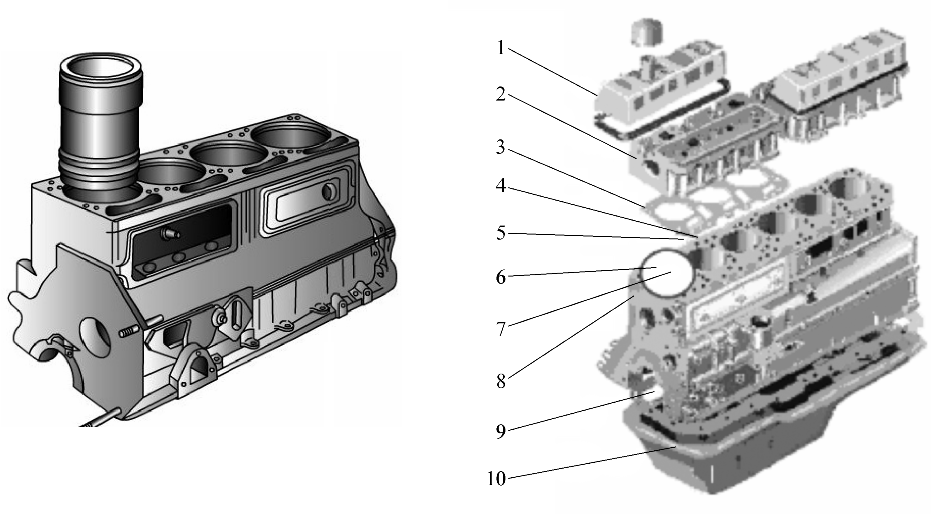


Fig. 2-1-2 Cylinder block

1—cylinder head cover 2—cylinder head 3—cylinder pillow

4—water jacket 5—oil gallery 6—cylinder 7—cylinder sleeve

8—engine block 9—crankcase 10—oil pan

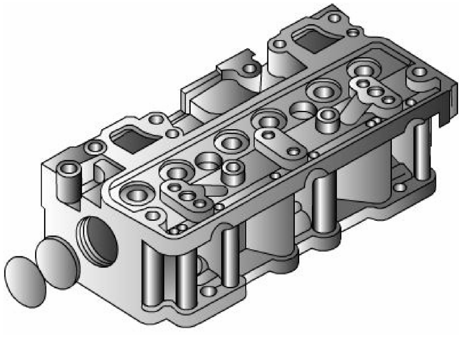


Fig. 2-1-3 Cylinder head

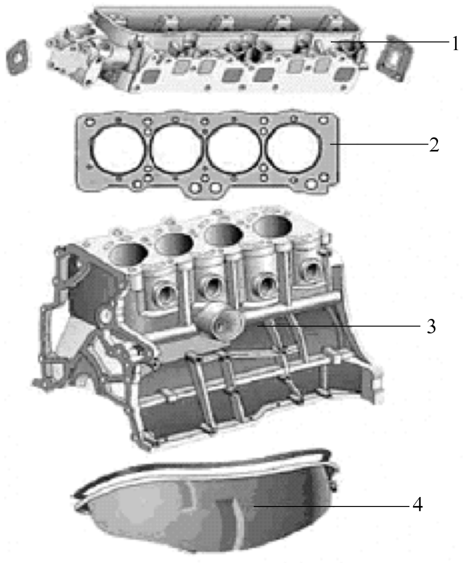


Fig. 2-1-4 Block group

1—cylinder head 2—cylinder pillow

3—cylinder block 4—oil pan

3. Piston and Connecting Rod Assembly

The piston and connecting rod assembly transmits the power from combustion to the crankshaft. It's shown in Fig. 2-1-5, mainly consists of piston, compression rings, oil control rings, piston pin and connecting rod.

(1) Piston

Piston fits closely within the engine cylinder or liner and is able to move alternately up and down in the cylinder.

(2) Piston Rings

There are two types of piston rings—compression and oil control rings. The compression rings are used to seal the pressures of compression and power. The oil control rings are employed to scrape oil from the cylinder walls.

(3) Piston Pin

It is used to connect piston to connecting rod.

(4) Connecting Rod

It is used to connect piston to crankshaft, and it changes the reciprocating motion to the rotary motion.

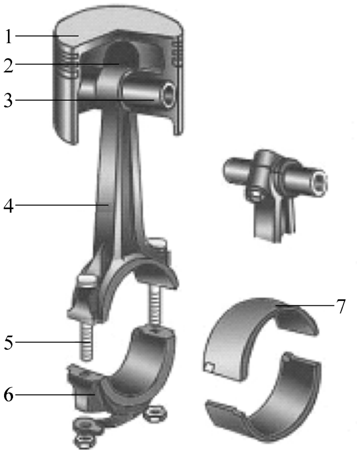


Fig. 2-1-5 Piston and rod assembly

1—piston 2—piston rings

3—piston pin 4—connecting rod

5—connecting rod bolts

6—connecting rod cap

7—connecting rod bearing

4. Crankshaft Assembly

It is bolted to the bottom of the cylinder block. The crankshaft is a one-piece casting or forging of heart-treated alloy steel of considerable mechanical strength. It must be strong enough to take the downward thrusts of the pistons during the power strokes without excessive distortion. In addition, it must be carefully balanced to eliminate undue vibration resulting from the weight of the offset cranks. To provide balance, crankshafts have counterweights opposite the cranks. Crankshafts have drilled oil passages through which oil can flow from the main to the connecting-rod bearings. The crankshaft assembly includes the crankshaft, bearings, flywheel, harmonic balancer, timing gear, front and rear seals. Fig. 2-1-6 shows crankshaft assembly.

5. Camshaft Assembly

The camshaft is driven by the crankshaft and used to open and close the valves. Most pistons are made from cast aluminum. The piston, through the connecting rod, transfers to the crankshaft the force created by the burning fuel mixture. This force

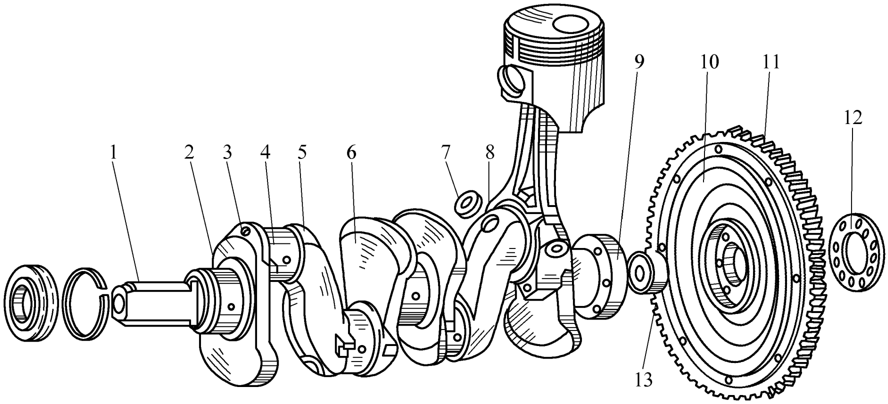


Fig. 2-1-6 Crankshaft assembly

1—crankshaft front end 2—front main journal 3—oil passage hole

4—crank pin 5—crank web 6—counter weight 7—oil passage plug

8—oil passage 9—crankshaft collar 10—flywheel

11—flywheel gear ring 12—flywheel lock plate 13—clutch shaft bearing

turns the crankshaft. The camshaft assembly includes the camshaft, camshaft timing gear, camshaft bearing, timing chain, and belt(if used). See Fig. 2-1-7.

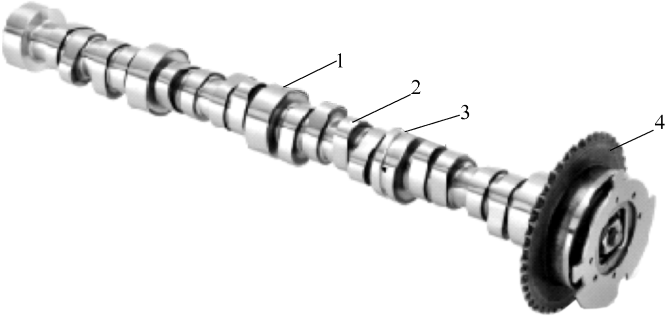


Fig. 2-1-7 Camshaft

1—camshaft journal 2—cam

3—oil hole 4—timing gear

6. Flywheel

The flow of power from the engine cylinder is not smooth. Although the power impulse overlap (on six and eight-cylinder engines), there are times when more power is being delivered than at other times. This tends to make the crank-

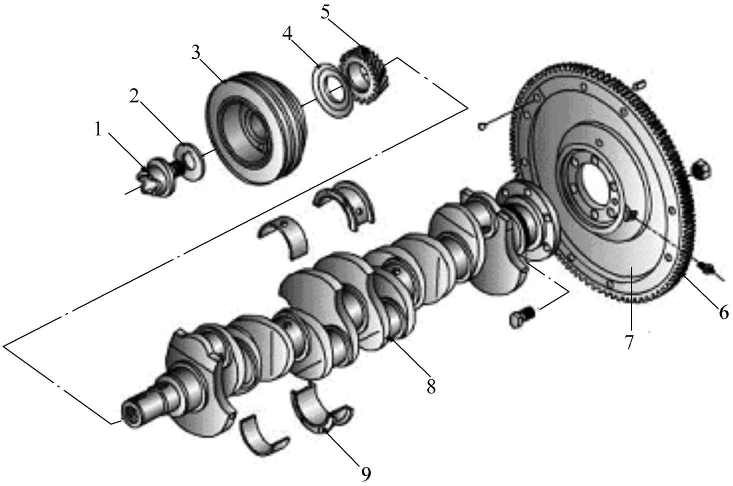


Fig. 2-1-8 The crankshaft and flywheel assembly

1—cranking claw 2, 4—side ring 3—belt pulley

5—timing gear 6—gear ring 7—flywheel

8—crankshaft 9—main bearing brush

shaft speed up and then slow down. However, the flywheel combats the tendency. The flywheel is a comparatively heavy wheel bolted to the rear end of the crankshaft. The inertia of the flywheel tends to keep it turning at constant speed. Thus, the flywheel absorbs energy as the crankshaft tries to speed up and gives back energy as the crankshaft tries to slow down. In effect, the flywheel absorbs power from the engine during the power stroke(or speed up time) and then gives it to the engine during the other three strokes(or slow down time) of the cycle. See Fig. 2-1-8and Fig. 2-1-9.

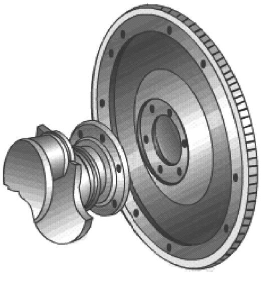


Fig. 2-1-9 Flywheel

7. Crankshaft and Connecting Rod Mechanism

Crankshaft and connecting rod mechanism is the engine sport bodies. Its function is to transform piston reciprocating movement into the crankshaft rotational movement. At the same time, crankshaft and connecting rod mechanism changes the press on the pistons into the external output torque of the crankshaft to drive vehicle wheel rotation. See Fig. 2-1-10.

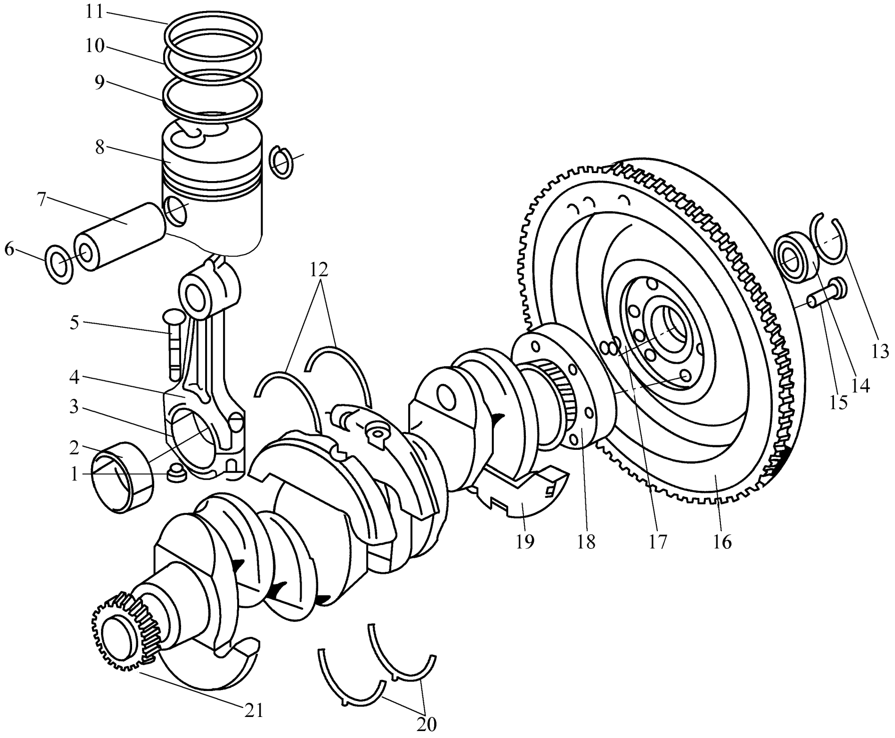


Fig. 2-1-10 Crankshaft and connecting rod mechanism

1—nut 2—bearing 3—connecting-rod top 4—connecting-rod body
5—connecting-rod bolts 6—bead flange 7—piston pin
8—piston 9—oil ring 10—below gaseous ring 11—submit gaseous ring
12—submit thrust washers 13—bead flange 14—bearing
15—flywheel bolt 16—flywheel 17—locating pin
18—crankshaft 19—balance weight 20—below thrust washers
21—crankshaft timing gear

New Words and Expressions

combustion	n.	燃烧
chamer	n.	室，箱
crankshaft	n.	曲轴
rotate	vt. /vi.	(使)旋转
circulate	vt. /vi.	(使)循环
camshaft	n.	凸轮轴

forging	n.	锻件
strength	n.	强度
distortion	n.	扭曲
excessive	adj.	过多的，过度的
eliminate	vt.	淘汰，剔除
undue	adj.	不适当的，过分的
offset	adj.	偏移的
drill	v. /n.	钻
sprocket	n.	扣链齿(链轮上与链条结合的齿)
pulley	n.	滑轮
flywheel	n.	飞轮
impulse	n.	脉冲
overlap	v. /n.	搭接
bolt	v.	用螺栓固定

combustion chamber	燃烧室
connecting rod	连杆
one-piece	整体的
in effect	实际上
cylinder block	气缸体
cylinder head	气缸盖
oil pan	油底壳
compression ring	气环
piston pin	活塞销
water jacket	水套
intake manifold	进气歧管
spark plug	火花塞
timing gear	正时齿轮
cylinder wall	气缸体
balance weight	平衡重
oil control ring	油环

Exercises

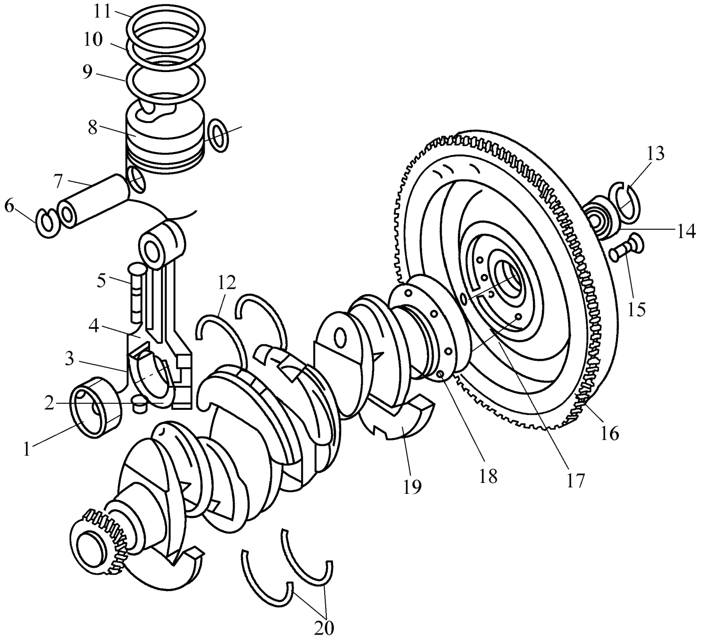
Ⅰ. Answer the following questions according to the text.

1. Which component's function is to transform piston reciprocating movement into

the crankshaft rotational movement?

2. What components does the group block include?
3. The engine requires five systems. What are they?
4. There are two types of piston rings. What are they?

Ⅱ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________
5. ________ 6. ________ 7. ________ 8. ________
9. ________ 10. ________ 11. ________ 12. ________
13. ________ 14. ________ 15. ________ 16. ________
17. ________ 18. ________ 19. ________ 20. ________

Ⅲ. Translate the following paragraph into Chinese.

1. The engine is the source of power that makes the wheels do around and the car move. The automobile engine is an internal combustion engine because the fuel(gasoline)is burned inside it. The burning of gasoline inside the engine produces high pressure in the engine combustion chamber. This high pressure forces piston to move, the movement is carried by connecting rods to the engine crankshaft. The crankshaft is thus made to rotate: the rotary motion is carried through the power train to the car wheels so that they rotate and the car moves.

2. The flywheel is a comparatively heavy wheel bolted to the rear end of the crankshaft. The inertia of the flywheel tends to keep it turning at constant speed. Thus, the flywheel absorbs energy as the crankshaft tries to speed up and gives back energy as the crankshaft tries to slow down. In effect, the flywheel absorbs power from the engine during the power stroke(or speedup time)and then gives it to the engine during the other three strokes(or slowdown time)of the cycle.

Ⅳ. Translate the following phrases into Chinese or English.

1. oil pan ________________
2. ignition distributor ________________
3. connecting rod ________________
4. water jacket ________________
5. spark plug ________________
6. 气缸体 ________________
7. 活塞环 ________________
8. 排气阀 ________________
9. 平衡重 ________________

Unit 2 Kinds of Engine

There are a variety of engines, and most of them use the petroleum fuel and are known as gasoline engines. The vaporized liquid fuel is mixed up with the air, burnt and expanded to produce the power to drive the cars. This kind of engine is also called the internal combustion engine. Nowadays, cars are mostly equipped with the gasoline engines.

The automobile engines can be classified according to: 1. number of cylinders; 2. arrangement of cylinders; 3. arrangement of valves; 4. type of cooling; 5. number of cycles; 6. type of fuel burned; 7. type of ignition.

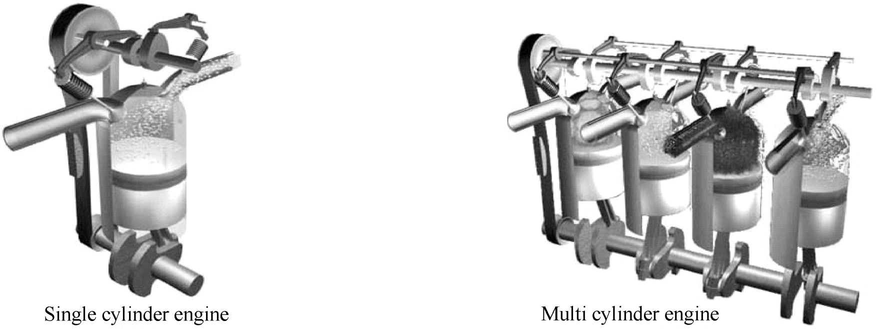
1. Classified by the Number of Cylinders

According to the number of cylinders, the automobile engines can be classified single cylinder engine and multi cylinder engine. See Fig. 2-2-1.

2. Classified by the Arrangement of Cylinders

The term engine configuration refers to the way that the cylinders of an engine are arranged. The cylinders can be in-line, opposed, or at an angle(V-type). Within these three basic arrangements, there are a number of variations.

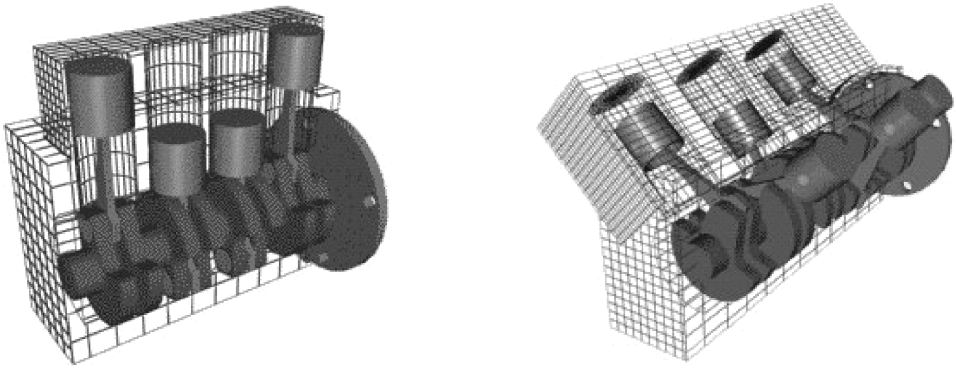
According to the arrangement of cylinders, the automobile engines can be classified in-line engine, V-type engine and horizontal-opposed engine or flat engine. See Fig. 2-2-2.



Single cylinder engine

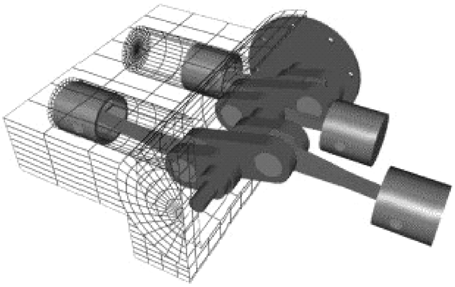
Multi cylinder engine

Fig. 2-2-1　The number of cylinders



In–line engine

V–type engine



Horizontal–opposed engine or flat engine

Fig. 2-2-2　The arrangement of cylinders

(1) In-Line Engine

With in-line engines, the cylinders are arranged in a straight line, one behind the other. Most in-line engines have their cylinders vertical, but some are slanted. That is, the engine is title at an angle to reduce the overall height. These engines are sometimes referred to as slanted engines.

Some in-line engines have their cylinders horizontal, so that the engine is more or less on its side. This reduces the overall height under the cab. The mechanical arrangement of four-cylinder in-line is commonly used for passenger cars.

(2) Horizontal-Opposed Engine

This arrangement has its cylinders arranged in two flat blanks with the crankshaft between them. The engine shown has a short rigid crankshaft with five bearings. A horizontal-opposed engine has even firing impulses and good balance. Movement of a piston in one direction is opposed by movement of a piston in the opposed direction.

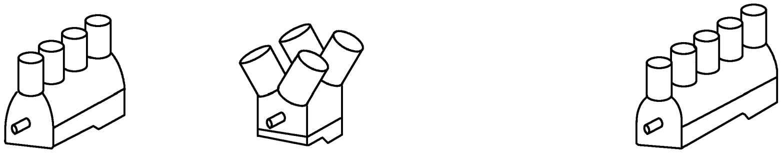
Horizontal-opposed engines, with their flat design, give the engine a low height and also help to keep the center of gravity of the vehicle low. A low center of gravity gives the vehicle stability.

(3) V-Type Engine

With V-type engines, the cylinders are arranged in two blanks at an angle. This reduces the length of the engine and makes it more compact. This also reduces the length of the crankshaft, which can be designed to be more rigid than a long shaft.

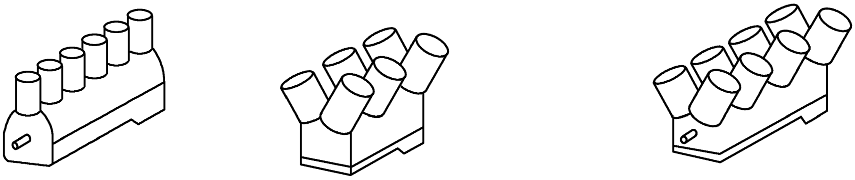
3. Classified by the Arrangement of Valves

According to the arrangement of valves, the automobile engines can be classified into four-cylinder engine, five-cylinder engine, six-cylinder engine and so on. See Fig. 2-2-3.



Four-cylinder engine

Five-cylinder engine



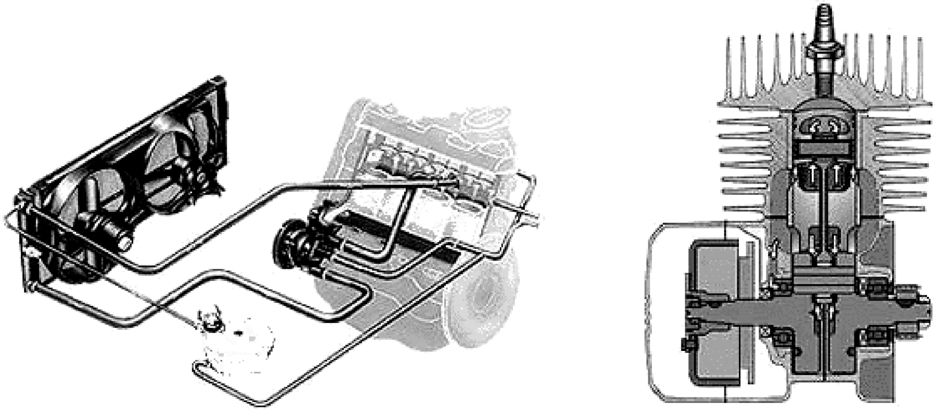
Six-cylinder engine

Eight-cylinder engine

Fig. 2-2-3 The arrangement of valves

4. Classified by the Type of Cooling

According to the type of cooling, the automobile engines can be classified into water-cooled or liquid-cooled engine and air-cooled engine. See Fig. 2-2-4.



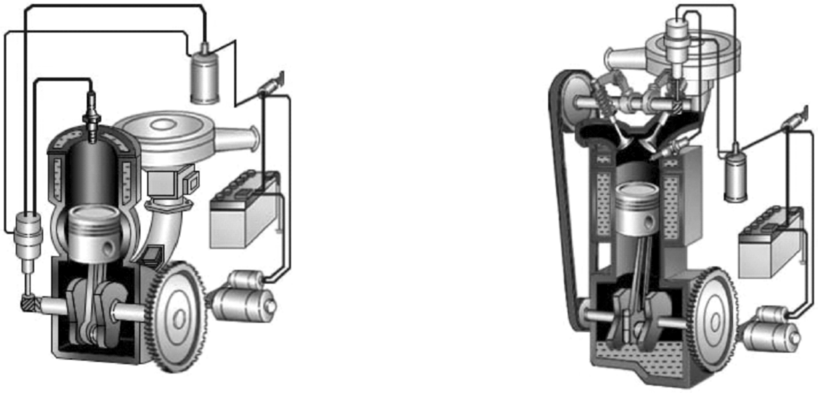
Water-cooled or liquid-cooled engine

Air-cooled engine

Fig. 2-2-4 Classified by the type of cooling

5. Classified by the Number of Cycles

According to the number of cycles, the automobile engines can be classified into two-stroke cycle engine and four-stroke cycle engine. See Fig. 2-2-5.



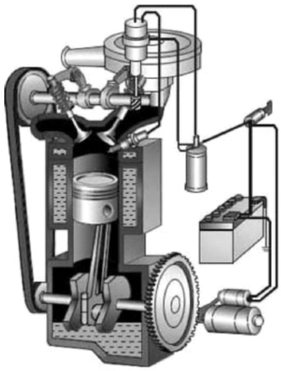
Two-stroke cycle engine

Four-stroke cycle engine

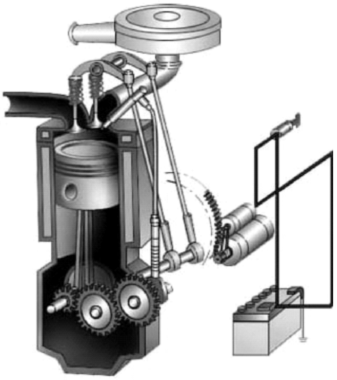
Fig. 2-2-5 Classified by the number of cycles

6. Classified by the Type of Fuel Burned

According to the type of fuel burned, the automobile engines can be classified into gasoline engine and diesel engine. See Fig. 2-2-6. The gasoline engine appearance structure is shown in Fig. 2-2-7.



Gasoline engine



Diesel engine

Fig. 2-2-6 Classified by the type of fuel burned

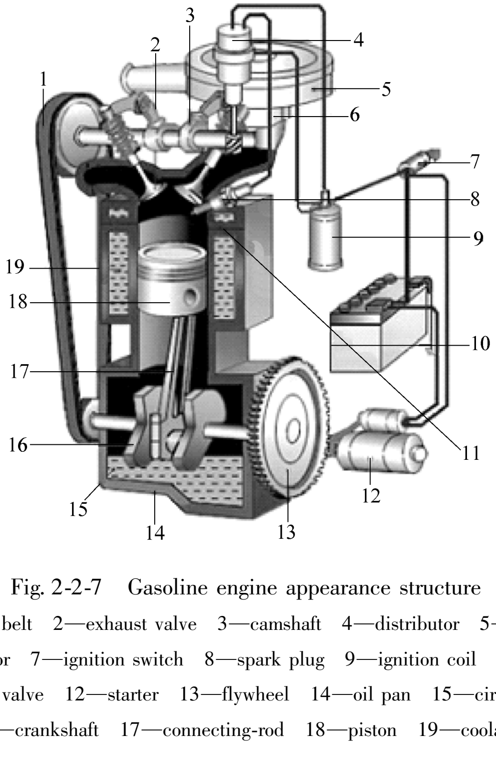


Fig. 2-2-7 Gasoline engine appearance structure

1—timing belt 2—exhaust valve 3—camshaft 4—distributor 5—air filter
6—carburetor 7—ignition switch 8—spark plug 9—ignition coil 10—battery
11—intake valve 12—starter 13—flywheel 14—oil pan 15—circulating oil
16—crankshaft 17—connecting-rod 18—piston 19—coolant

New Words and Expressions

petroleum	n.	石油
vaporize	v.	(使某物)汽化，蒸发
configuration	n.	配置，构造，结构，外形

variation	n.	变化，变动，变异
arrangement	n.	排列
compact	adj.	紧凑的，紧密的
rigid	adj.	坚硬的，不弯曲的，刚性的
gasoline	n.	汽油
diesel	n.	柴油机
carburetor	n.	化油器

timing belt	正时带
exhaust valve	排气门
oil pump	机油泵
circulating oil	循环机油，润滑油
in-line engine	直列式发动机
flat engine	顶置式发动机
intake valve	进气门
spark plug	火花塞
air filter	空气滤清器
multi-cylinder engine	多缸发动机
V-type engine	V 形发动机

Exercises

Ⅰ. Answer the following questions according to the text.

1. What types of engine can be classified according to type of fuel burned?
2. What types of engine can be classified according to number of cylinders?
3. What types of engine can be classified according to type of cooling?
4. What types of engine can be classified according to arrangement of cylinders?
5. What types of engine can be classified according to number of cycles?

Ⅱ. Translate the following phrases into Chinese or English.

1. multi-cylinder engine ________________
2. internal combustion engine ________________
3. combustion chamber ________________
4. timing belt ________________
5. in-line engine ________________
6. four-stroke cycle ________________
7. V 形发动机 ________________

8. 风冷式发动机 ________

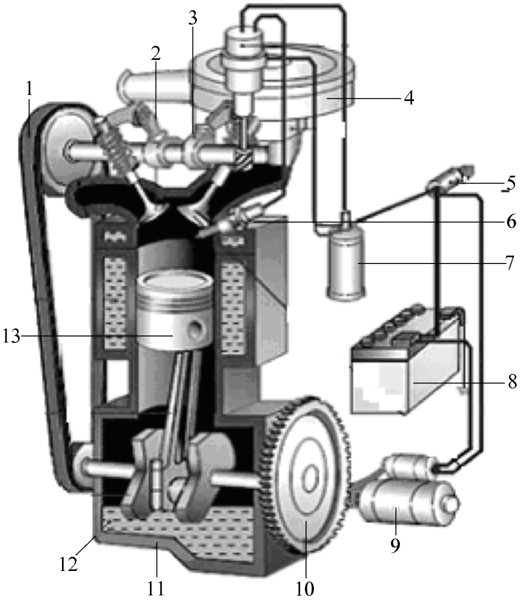
9. 空气滤清器 ________

10. 顶置式发动机 ________

Ⅲ. Translate the following paragraph into Chinese.

With V-type engines, the cylinders are arranged in two blanks at an angle. This reduces the length of the engine and makes it more compact. This also reduces the length of the crankshaft, which can be designed to be more rigid than a long shaft.

Ⅳ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________

5. ________ 6. ________ 7. ________ 8. ________

9. ________ 10. ________ 11. ________ 12. ________

13. ________

Ⅴ. Translate the following sentences into English.

1. 发动机气缸体构成了发动机的主要框架或基础。
2. 活塞由活塞顶部、活塞环、活塞环槽、活塞裙部以及活塞销孔组成。
3. 连杆的一端(大头)与曲轴连接，另一端(小头)与活塞连接。
4. 有各种各样的发动机，如电动机、蒸汽机和内燃机。

Unit 3 Engine Operating Principles

The actions taking place in the engine cylinder can be divided into four stages, or strokes. "Stroke" refers to piston movement; a stroke occurs when the piston moves from one limiting position to the other. The upper limit of piston movement is called TDC (top dead center). The lower limit of piston movement is called BDC (bottom dead center). A stroke is piston movement from TDC to BDC or from BDC to TDC. In other words, the piston completes a stroke each time, it changes its direction of motion.

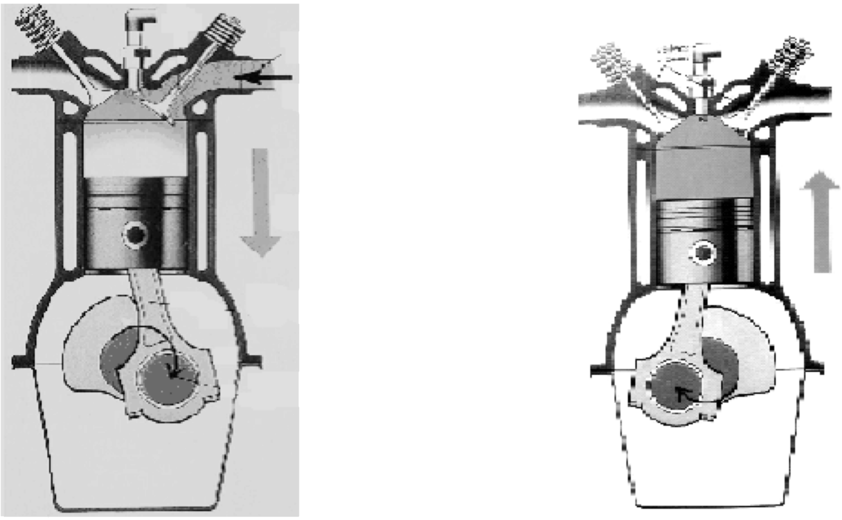
Almost all cars currently use a four-stroke combustion cycle to convert gasoline into motion. That is to say that the intake stroke, compression stroke, power stroke and exhaust stroke are one engine cycle. When the fourth stroke is completed, the cycle begins again. The four-stroke approach is also known as the Otto cycle, in honor of Nikolaus Otto, who invented it in 1867. The four strokes are illustrated in Fig. 2-3-1.

1. Intake Stroke

The first stroke is the intake stroke. As the piston starts down, the intake valve opens and the air-fuel mixture enters into the cylinder. When the piston reaches the bottom of the intake stroke, the intake valve closes, trapping the air-fuel mixture in the cylinder. During the stroke, the exhaust valve stays closed.

2. Compression Stroke

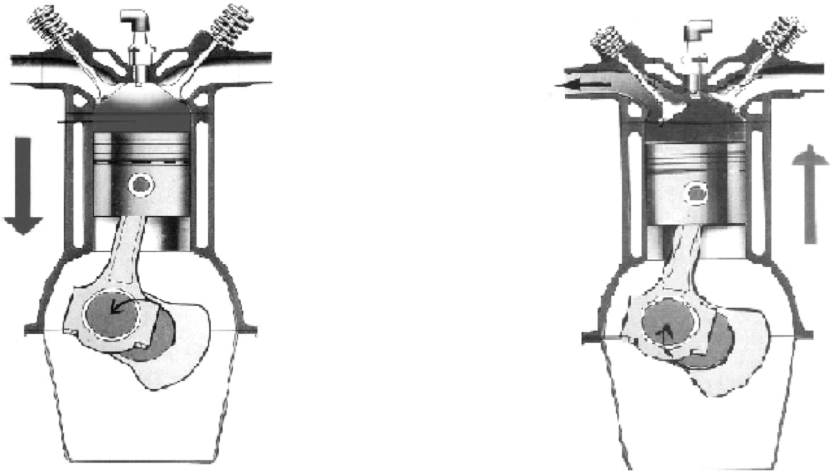
The second stroke is the compression stroke. The piston moves up in the cylinder



Intake stroke

Compression stroke

Fig. 2-3-1 Four strokes



Power stroke Exhaust stroke

Fig. 2-3-1 Four strokes(续)

with both valves closed and compresses the trapped air-fuel mixture. When the piston reaches the top of the cylinder, the pressure rises.

3. Power Stroke

The third stroke is the power stroke. Near the end of the compression stroke, the spark plug fires, igniting the compressed air-fuel mixture that produces a powerful explosion. The combustion process pushes the piston down the cylinder with great force turning the crankshaft to provide the power to drive the car.

4. Exhaust Stroke

The fourth stroke is the exhaust stroke. With the piston at the bottom of the cylinder, the exhaust valve open, and the piston moves up again and forces the burned gases out of the cylinder. The piston travels up to the top of the cylinder pushing all the exhaust out before closing the exhaust valve in preparation for starting the four-stroke process over again.

New Words and Expressions

piston	n.	活塞
cylinder	n.	气缸
explosion	n.	爆裂(声), 爆炸(声)
stroke	n.	行程, 冲程
cycle	n.	循环, 周期
approach	n.	方法, 步骤
illustrate	vt.	图解, 说明

trap	vt.	收集，留住，截留

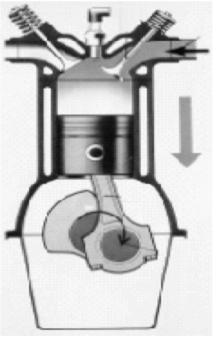
upper limit	上限
lower limit	下限
take place	发生
divide. . . into	把……分为
TDC(top dead center)	上止点
BDC(bottom dead center)	下止点
refer to	涉及，有关系
in honor of	以纪念……
intake valve	进气门
exhaust valve	排气门
intake stroke	进气行程
compression stroke	压缩行程
power stroke	做功行程
exhaust stroke	排气行程
air-fuel mixture	空气燃油混合气
burned gas	废气

Exercises

Ⅰ. Answer the following questions according to the text.

1. What do TDC and BDC stand for ?
2. What does a stroke mean ?
3. What do the four strokes refer to ?
4. What is the four-stroke approach also known as?

Ⅱ. Write out the strokes according to the picture.



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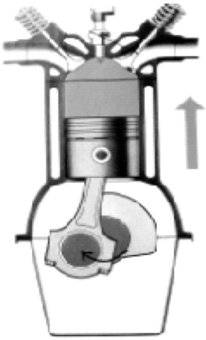

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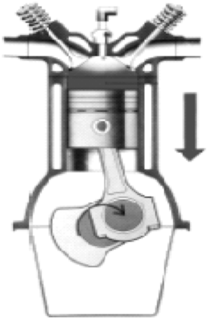

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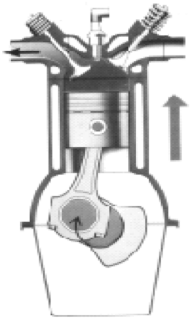

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Ⅲ. Translate the following paragraph into Chinese.

The third stroke is the power stroke. Near the end of the compression stroke, the spark plug fires, igniting the compressed air-fuel mixture that produces a powerful explosion. The combustion process pushes the piston down the cylinder with great force turning the crankshaft to provide the power to drive the car.

Ⅳ. Abbreviations are very useful in practical work. Do you know the following English abbreviations you often come across in handling automotive materials? Read them and then translate them into corresponding Chinese terms.

1. AFV	alternative-fuel vehicle	________
2. ATV	advanced-technology vehicle	________
3. HEV	hybrid-electric vehicle	________
4. TDC	top dead center	________
5. BDC	bottom dead center	________
6. ECS	engine control system	________

Ⅴ. Fill in the blanks with the suitable words or phrases given below, changing the form.

where necessary.

convert. . . into
four stroke cycle
electric motor
internal combustion engine
diesel engine
engine

1. The ________ is generally considered the " heart " of an automobile.

2. The ________ is the one most commonly used in the automotive field.

3. According to the fuel energy used, the internal combustion engines are also divided into gasoline engines, and ________.

4. The piston ________ the potential energy of the fuel ________ the kinetic energy.

5. This ________ of piston within the cylinder is repeated time and again to push the vehicle forward.

6. There are actually various types of engines such as ________, steam engines, and internal combustion engine.

Unit 4 EFI System

Electronic fuel injection(EFI)system collects information through various sensors, and the computer controls the operation of fuel injectors based on the information. Electronic fuel injection works on some very basic principles. It can be divided into

three basic sub-systems: the fuel delivery system, air induction system and electronic control system.

To ensure the engine works regularly, enough fuel and air are needed. The function of the fuel supply system is to supply the clean fuel to the engine and to control the supply amount. There are two types of fuel supply equipment: the carburetor and the electrical controlled. For the sake of the development of technology and the requirement of the environmental protection, the electrical controlled is used widely while the carburetor is already obsolete. Fuel delivery system is shown in Fig. 2-4-1and Fig. 2-4-2 shows some components of it.

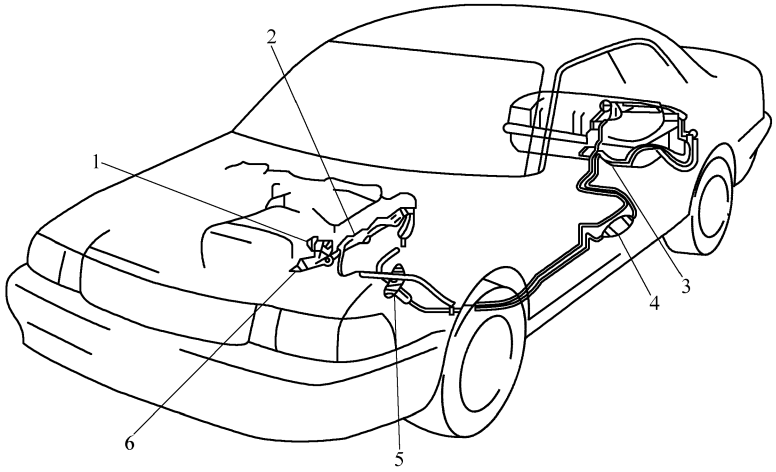
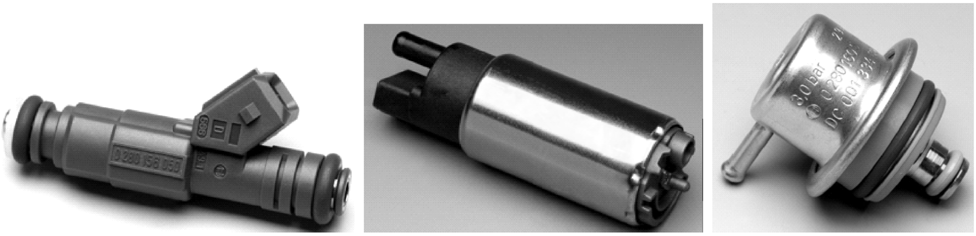


Fig. 2-4-1 Fuel delivery system

1—fuel pressure regulator 2—delivery pipe 3—fuel pump 4—fuel filter

5—fuel pressure pulsation damper 6—injector



Fuel injector Fuel pump Fuel pressure regulator

Fig. 2-4-2 Some components of the fuel supply system

The function of the intake system is to inhale the air for the gasoline burning. Fig. 2-4-3 shows the components of an air intake system.

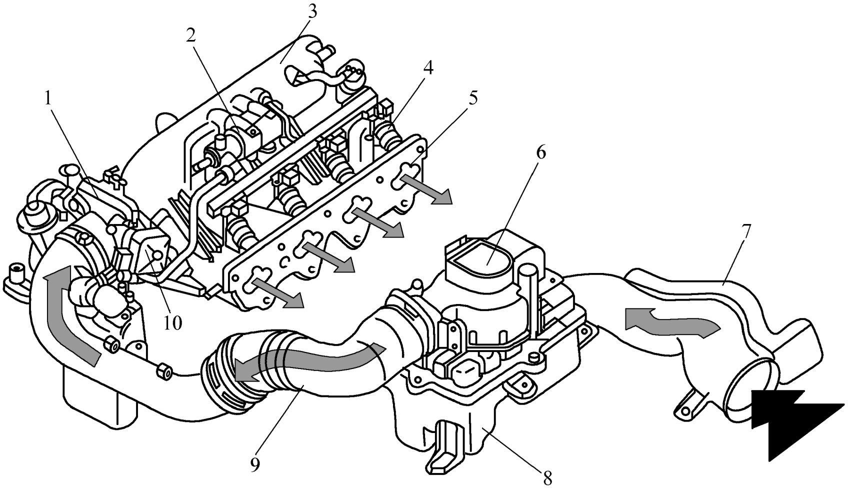


Fig. 2-4-3 The structure of the intake air system

1—throttle body 2—idle air control valve 3—intake pipe 4—injector 5—intake manifold

6—air flow meter 7—resonator 8—air cleaner 9—intake flow pipe 10—throttle position sensor

Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combustion chamber.

At low temperatures, the IAC valve opens and the air flows through the IAC valve and the throttle body, into the air intake chamber. During engine warming up, even if the throttle valve is completely closed, air flows into the air intake chamber, thereby increasing the idle speed (first idle operation).

The air intake chamber prevents pulsation of the intake air. It also prevents intake air interference in each cylinder.

The engine electronic control system consists of various sensors, switches and actuators. The various sensors detect the intake air pressure, engine speed, oxygen density in the exhaust gas, engine coolant temperature, intake air temperature and atmospheric pressure, etc., and convert the information into an electrical signal, which is sent to the ECM. Based on these signals, the ECM determines the injection volume (timing) and calculates the optimum ignition timing for the current conditions.

The ECM controls not only the fuel injection timing, but also the self-diagnostic function which records the occurrence of a malfunction, ignition timing control, idle speed control and EGR control. The electronic control system is shown in Fig. 2-4-4 and Fig. 2-4-5.

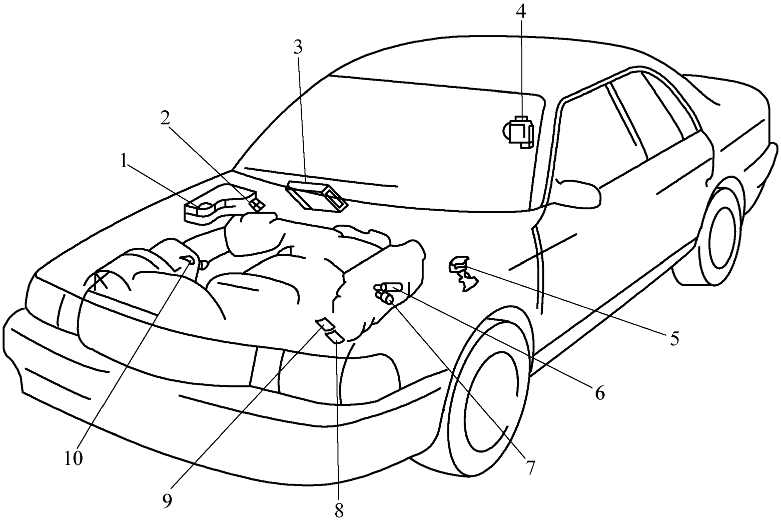


Fig. 2-4-4 Electronic control system

1—EFI manifold relay 2—variable resistor 3—engine(& ECT)ECU

4—fuel pump ECU 5—vacuum sensor 6—ACIS VSV 7—No. 2 knock sensor

8—No. 1 knock sensor 9—water temperature sensor 10—intake air temperature sensor

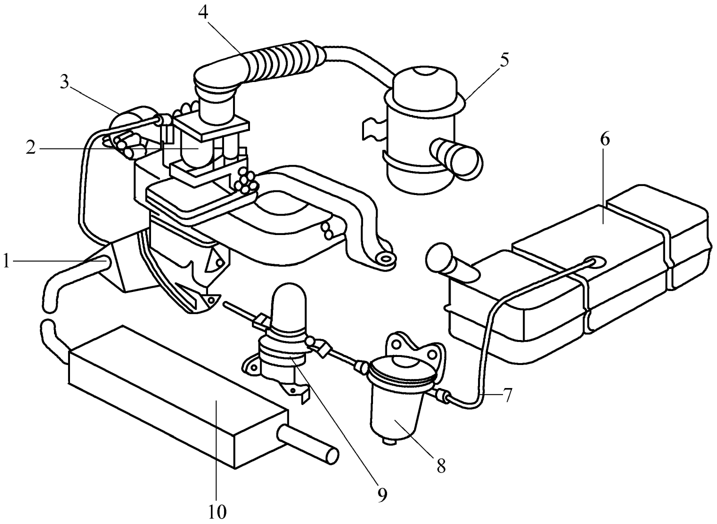


Fig. 2-4-5 Gasoline engine fuel system

1—exhaust pipe 2—carburetor 3—intake manifold 4—intake tube 5—air filter

6—gasoline tank 7—pipe 8—gasoline filter 9—gasoline pump 10—muffler

There are different types of gasoline fuel injection systems used in automobiles. The two basic arrangements in EFI system are port fuel injection and throttle body injection(TBI).

Throttle Body Fuel Injection is also called single point fuel injection system. Fuel is injected into the area around the throttle valve, where air velocity is at a maximum, thus ensuring fuel droplets are thoroughly atomized and will be distributed throughout the air mass.

Port Fuel Injection(also called multiple-point fuel injection) systems use a solenoid fuel injector with a coil and a spring to open and close the needle valve in each cylinder. Gasoline is injected into the intake manifold above the intake valve 70-100mm.

New Words and Expressions

pump	n.	泵；v. （用泵）抽水，抽吸
regulator	n.	调节器
sensor	n.	传感器
throttle	n.	节气门
injection	n.	喷射，注射
injector	n.	喷油器
filter	n.	滤清器
actuator	n.	执行器
oxygen	n.	氧
atmospheric	adj.	大气的
signal	n.	信号；v. 发信号
optimum	n.	最适宜；adj. 最适宜的

electronic fuel injection(EFI)	电子控制燃油喷射
fuel delivery system	燃油供给系统
air induction system	进气系统
electronic control system	电子控制系统
air filter	空气滤清器
fuel filter	燃油滤清器
port fuel injection	进气口燃油喷射
throttle body injection	节气门体燃油喷射
air flow meter	空气流量计

air intake chamber	进气歧管室
fuel injector	喷油器

Exercises

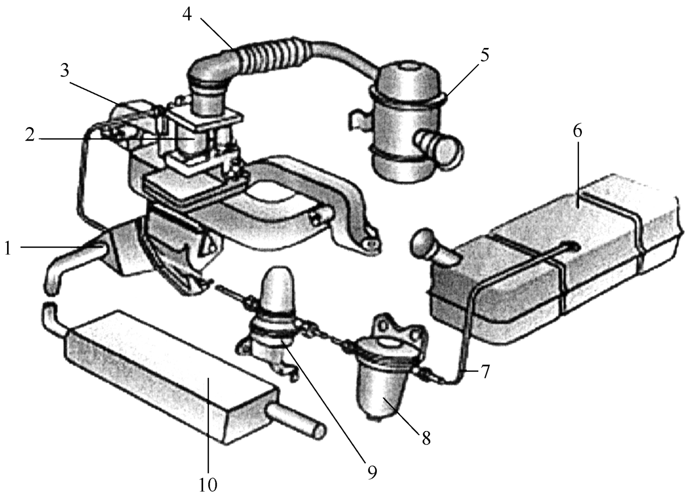
Ⅰ. Answer the following questions according to the text.

1. Which basic sub-systems is EFI system composed of?
2. What is the function of the intake system?
3. What is the function of the fuel system?
4. Please name the major parts that make up the fuel system.

Ⅱ. Translate the following paragraph into Chinese.

The Engine Electronic Control System consists of various sensors, switches and actuators. The various sensors detect the intake air pressure, engine speed, oxygen density in the exhaust gas, engine coolant temperature, atmospheric pressure, etc., and convert the information into an electrical signal, which is sent to the ECM. Based on these signals, the ECM determines the injection volume (timing) and calculates the optimum ignition timing for the current conditions.

Ⅲ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________ 5. ________

6. ________ 7. ________ 8. ________ 9. ________ 10. ________

Ⅳ. Abbreviations are very useful in practical work. Do you know the following English abbreviations you often come across in handling automotive materials? Read them and then translate them into corresponding Chinese terms.

1. EFI electronic fuel injection ________________

2. TV throttle valve ____________

3. A/F air/fuel ratio ____________

4. TBI throttle body injection ____________

5. DFI direct fuel injection ____________

6. IATS intake air temperature sensor ____________

V. Translate the following sentences into English.

1. 燃油系统的主要部件包括燃油箱、输油泵、燃油滤清器、化油器以及油管等。

2. 燃油箱用以储存燃油。

3. 输油泵的作用是把燃油从燃油箱输送至化油器。

4. 在发动机的所有工况下，电子控制燃油喷射系统均能提供一个准确的空燃比。

Unit 5 Valve Train

1. The Function and Components of the Valve Train

The function of the valve train is to open and close the intake and exhaust ports of the cylinders to ensure that the burning mixture can pour into the cylinder and let out the exhaust gas in time. The valve train typically includes the camshaft, valves, valve springs, rocker arms, valve lifter and push-rod. See Fig. 2-5-1.

There are two openings, or ports, in the enclosed end of the cylinder. One of the ports permits the mixture of air and gasoline vapor to enter the cylinder. The other port permits the burned gases, after combustion, to exhaust, or escape, from the cylinder. The two ports have valves assembled into them. These valves close off one or the other port, or both ports, during the various stages of engine operation. That is to say, each cylinder has two valves, an intake valve and an exhaust valve. The cam lobes on the

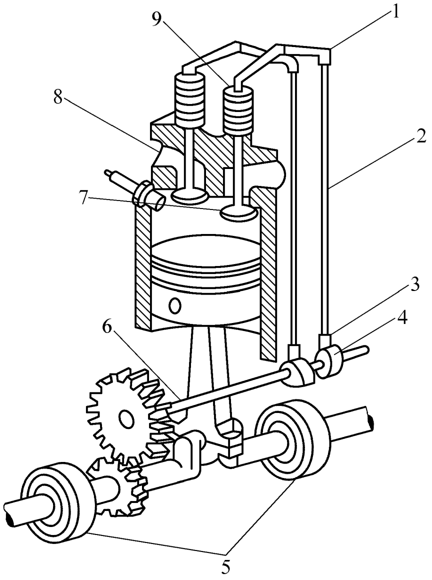


Fig. 2-5-1 Typical valve train

1—rocker arm 2—push rod 3—valve lifter
4—cam 5—bearing 6—camshaft
7—valve 8—port 9—valve spring

camshaft are so related to the crankshaft crankpins through the gears or sprockets and chain as to cause the valves to open and close with the correct relationship to the piston strokes. Valves are usually made from a steal alloy such as a mixture of steel and nickel, or steel and silicon. Exhaust valves must withstand extremely high temperatures up 815℃ without damaging the valve. See Fig. 2-5-2.

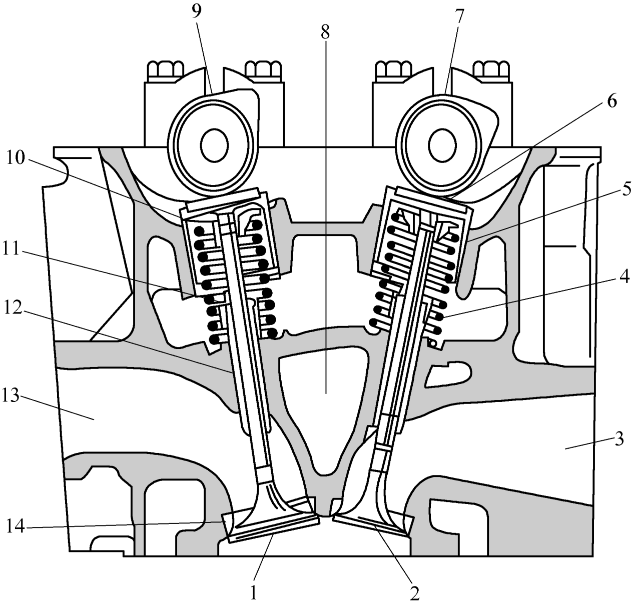


Fig. 2-5-2 Components of valve

1—intake valve 2—exhaust valve 3—exhaust port 4—valve spring 5—valve lifter
6—adjusting shim 7—exhaust camshaft 8—water jacket 9—intake camshaft
10—valve spring retainer 11—oil seal 12—valve guide 13—intake port 14—valve seat

The camshaft is a rotating shaft that has lobes, called cams, opening and closing the intake and exhaust valves in time with the motion of the piston. When the cam pushes against the lifter, the lifter in turn pushes the valve open. When the cam rotates away from the lifter, the valve is closed by a spring that is attached to the valve. There is a cam on the camshaft for each valve, or two cams per cylinder. The camshaft is driven by gears, or by a chain, from the crankshaft. It turns at one-half crankshaft speed. In the four-cycle engine, every two revolutions of the crankshaft produce one revolution of the camshaft and one opening and closing. The cam lobes are so positioned on the camshaft as to cause the valves to open and close in the cylinders at the proper time with respect to the actions taking place in the cylinders. See Fig. 2-5-3.

Springs return the valves to their closed position after rocker arms press down on the valves, opening them. These springs have to be very strong because at high engine speeds, the valves are pushed down very quickly, and it is the springs that keep the valves in contact with the rocker arms. If the springs were not strong enough, the valves might come away from the rocker arms and snap back. This is an undesirable situation that would result in extra wear on the cams and rocker arms. See Fig. 2-5-4 and Fig. 2-5-5.

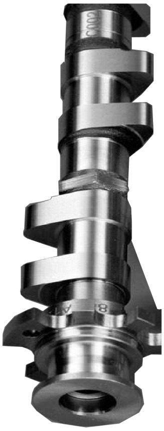


Fig. 2-5-3 Camshaft

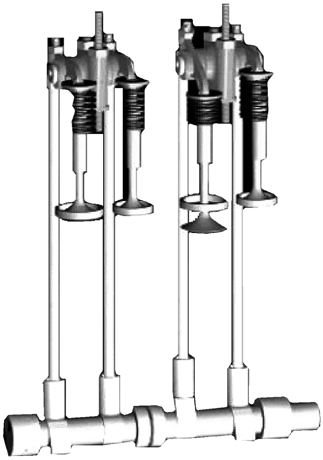


Fig. 2-5-4 Push-rod

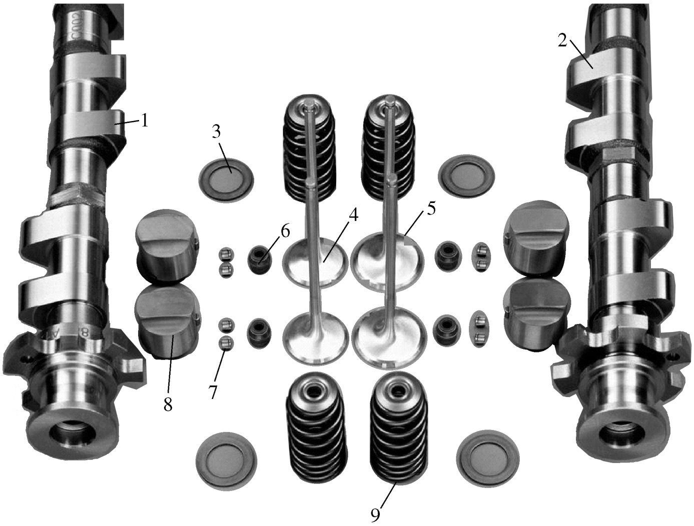


Fig. 2-5-5 Material object map of valve assembly

1—exhaust camshaft 2—intake camshaft 3—washer 4—exhaust valve 5—intake valve
6—valve oil seal 7—valve locks 8—valve lifter 9—valve spring

The cam is an egg-shaped piece of metal on a shaft that rotates in coordination with the crankshaft. The metal shaft, called the camshaft, typically has individual cams for each valve in the engine. As the camshaft rotates, the lobe, or high spot of the cam, pushes against parts connected to the stem of the valve. This action forces the valve to move downward. This action could open an inlet valve for an intake stroke, or open an exhaust valve for an exhaust stroke. See Fig. 2-5-6.

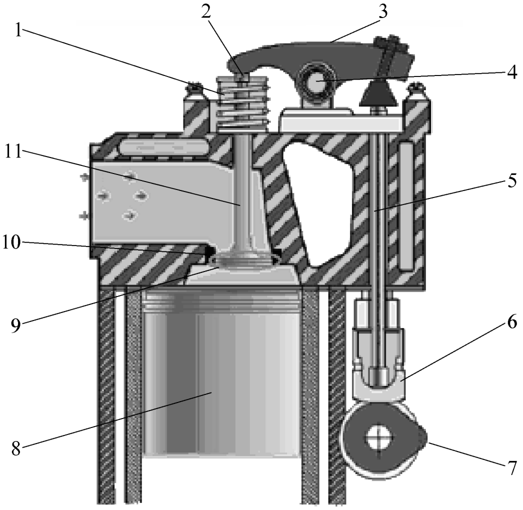


Fig. 2-5-6 Valve operation

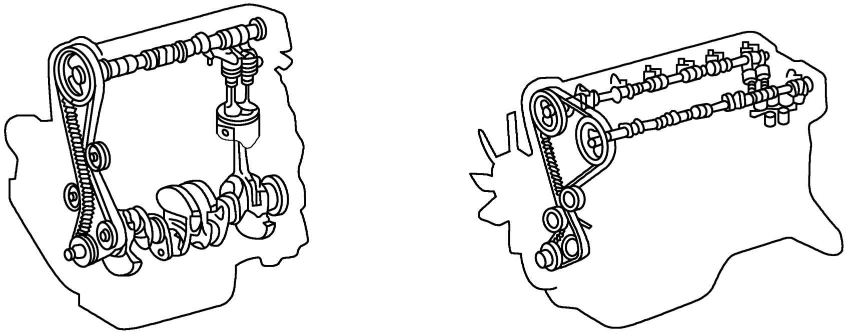
1—valve spring 2—valve clearance 3—rocker arm 4—rocker shaft 5—push rod 6—tappet 7—camshaft 8—piston 9—valve head 10—valve seat 11—valve stem

2. Types of Valve Train

Some engines have two camshafts on each head, one for the intake valves and one for the exhaust valves. These engines are called double overhead camshaft (DOHC). Engine with the other type is called single overhead camshaft (SOHC) Engine. Engine with the camshaft in the block is called overhead valves (OHV) Engine. See Fig. 2-5-7.

(1) Double Overhead Camshafts

A double overhead camshafts engine has two camshafts per head. So in-line engines have two camshafts, and V-type engines have four. Usually, double overhead camshafts are used on engines with four (or more) valves per cylinder. The main reason to use double overhead camshafts is to allow for more intake and exhaust valves. More valves mean that intake and exhaust gases can flow more freely because there are more openings for them to flow through. This increases the power of the engine. See Fig. 2-5-8.



SOHC DOHC

Fig. 2-5-7 The arrangement ways of the valve train

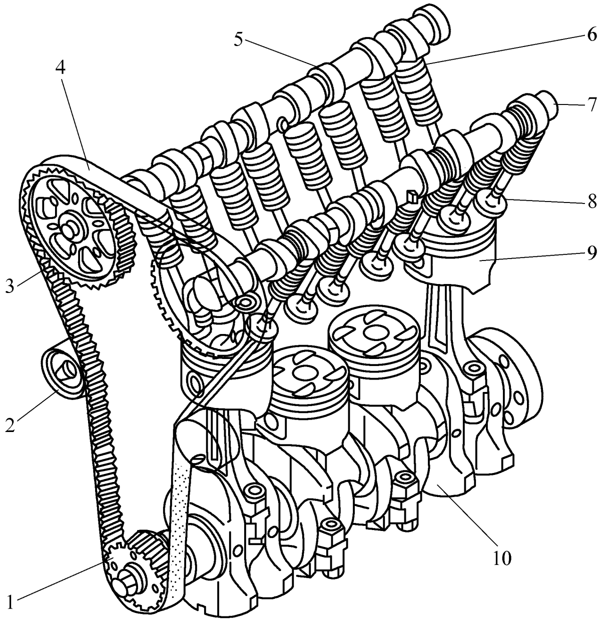


Fig. 2-5-8 Double overhead camshafts

1—crankshaft timing pulley 2—tensioner pulley 3—camshaft timing pulley
4—timing belt 5—intake camshaft 6—valve lifter 7—exhaust camshaft
8—valve 9—piston 10—crankshaft

（2） Single Overhead Camshaft

This arrangement denotes an engine with a single camshaft per head. So if it is an in-line-4 cylinder or in-line-6 cylinder engine, it will have one camshaft; if it is a V6 or V8 engine, it will have two camshafts (one for each head). Fig. 2-5-9.

(3) Overhead Valve(OHV)Engine

Like SOHC and DOHC engines, the valves in a overhead valve engine are located in the head, above the cylinder. The key difference is that the camshaft on overhead valve engine is inside the engine block, rather than in the head.

3. Types of Camshaft Drive Mechanism

In most engines, a belt or chain called the timing belt or timing chain(similar to a bicycle chain) connects the camshaft with the crankshaft. These belts and chains need to be replaced or adjusted at regular intervals. If a timing belt breaks, the cam stop spinning and the piston could hit the open valves. See Fig. 2-5-10 and Fig. 2-5-11.

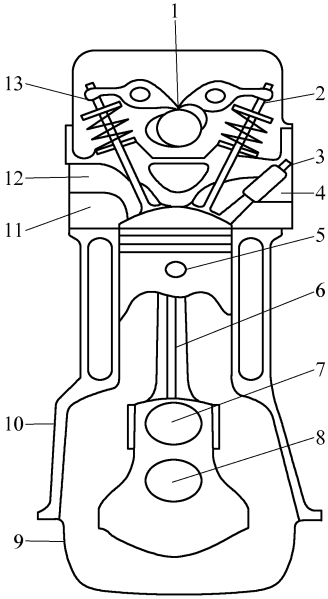
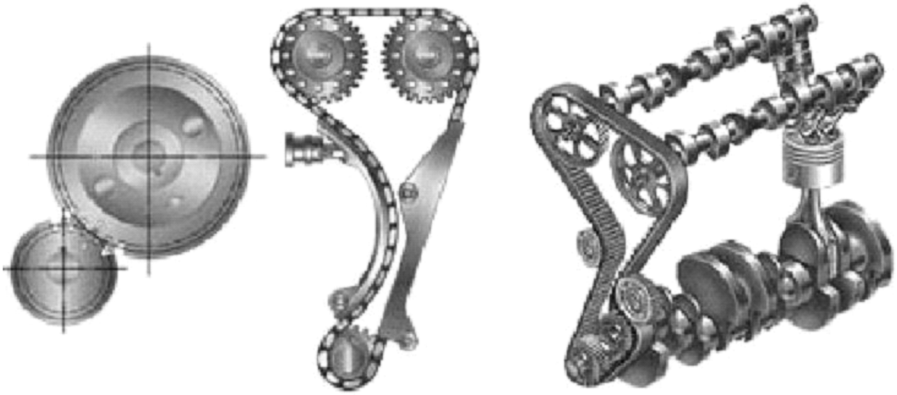


Fig. 2-5-9 Single overhead camshaft

1—camshaft 2—exhaust valve 3—spark plug 4—exhaust port 5—piston 6—connecting rod 7—rod bearing 8—crankshaft 9—oil pan 10—block 11—head 12—intake port 13—intake valve



Gear drive Chain drive Belt drive

Fig. 2-5-10 Camshaft drive ways

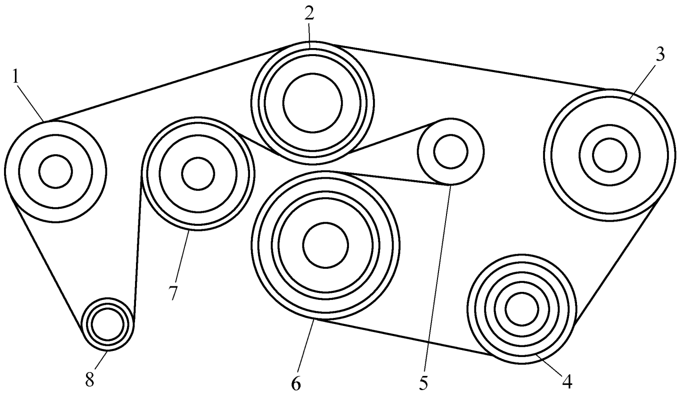


Fig. 2-5-11 Engine belts coiled snake-like map

1—air pump 2—coolant pump 3—power steering pump 4—A/C compressor
5—automatic belt tensioner 6—crankshaft 7—cooling fan 8—generator

New Words and Expressions

camshaft	n.	凸轮轴
pushrod	n.	推杆
lobe	n.	凸轮，凸耳
cam	n.	凸轮
nickel	n.	镍
silicon	n.	硅
withstand	vt.	抵挡，经受住
valve	n.	气门
spring	n.	弹簧
stud	n.	螺栓，双头螺柱
pivot	n.	枢轴

valve train		配气机构，气门机构
valve spring		气门弹簧
rocker arm		摇臂
valve lifter		挺柱
steel alloy		合金钢
intake port		进气口
exhaust port		排气口，排出孔
valve face		气门锥面
valve seat		气门座

timing belt	正时带
timing chain	正时链
double overhead camshafts(DOHC)	顶置双凸轮轴
single overhead camshaft(SOHC)	顶置单凸轮轴
overhead valve(OHV)	顶置气门
pushrod engine	推杆式发动机

Exercises

Ⅰ. Answer the following questions according to the text.

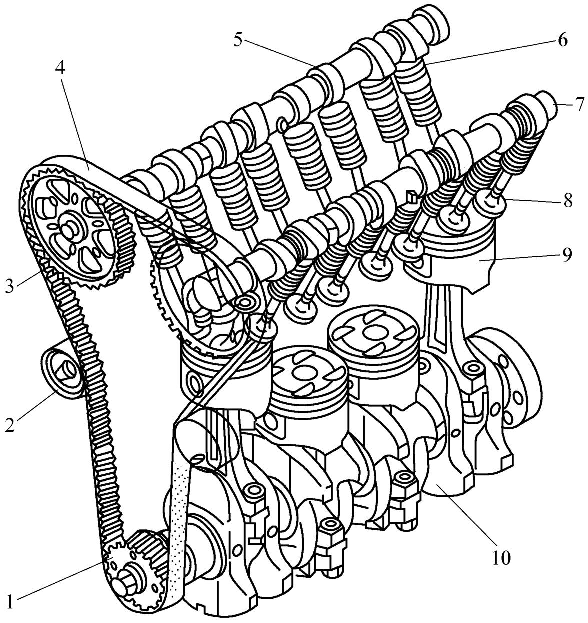
1. What is the function of the valve train?
2. Please name the major parts that make up valve train.
3. Please name the major types of valve train.
4. That is to say, each cylinder has two valves, what are they?

Ⅱ. Translate the following paragraph into Chinese.

The cam is an egg-shaped piece of metal on a shaft that rotates in coordination with the crankshaft. The metal shaft, called the camshaft, typically has individual cams for each valve in the engine. As the camshaft rotates, the lobe, or high spot of the cam, pushes against parts connected to the stem of the valve. This action forces the valve to move downward. This action could open an inlet valve for an intake stroke, or open an exhaust valve for an exhaust stroke.

Ⅲ. Write out the terms according to the picture.

1. ________ 2. ________
3. ________ 4. ________
5. ________ 6. ________
7. ________ 8. ________
9. ________ 10. ________



Ⅳ. Abbreviations are very useful in practical work. Do you know the following English abbreviations you often come across in handling automotive materials? Read them and then translate them into corresponding Chinese terms.

1.	DOHC	double overhead camshafts	________
2.	SOHC	single overhead camshaft	________
3.	OHV	overhead valve	________
4.	ECU	electronic control unit	________
5.	VVL	variable valve lift	________
6.	SUV	sport utility vehicle	

Unit 6 Engine Ignition System

The ignition system is part of the electric system of the automobile. It is used to ignite the air and fuel in the cylinder. In order to do this, a very high voltage is needed to force the electrical current to jump across the spark plug gap and cause an electrical spark. However, there is only a 12-volt battery within the automobile. The ignition system is designed to increase the voltage to the necessary amount at the right time for the spark to occur. In addition, the time of spark must be altered as speed and load increase or decrease.

The ignition system consists of three basic parts: the ignition distributor, the ignition coil, the spark plug, together with the connecting wires. See Fig. 2-6-1.

The ignition system may be classified as follows:

1) Conventional ignition system with contact breaker.

2) Electronic ignition system using semiconductors or transistors.

3) Computer-controlled ignition system.

The computer-controlled ignition system is composed of electronic control module (ECM), various sensors, battery, the ignition switch, igniter, ignition coil, distributor and the spark plugs. Fig. 2-6-2 shows a ignition system.

Components in the ignition system are as follows:

1) The battery is used to provide electrical energy needed to operate the system. The negative side is grounded to the frame, and the positive side is fed directly to the ignition switch.

2) The ignition switch connects or disconnects the flow of electricity to the ignition system.

3) The igniter temporarily interrupts the primary current with the ignition signal

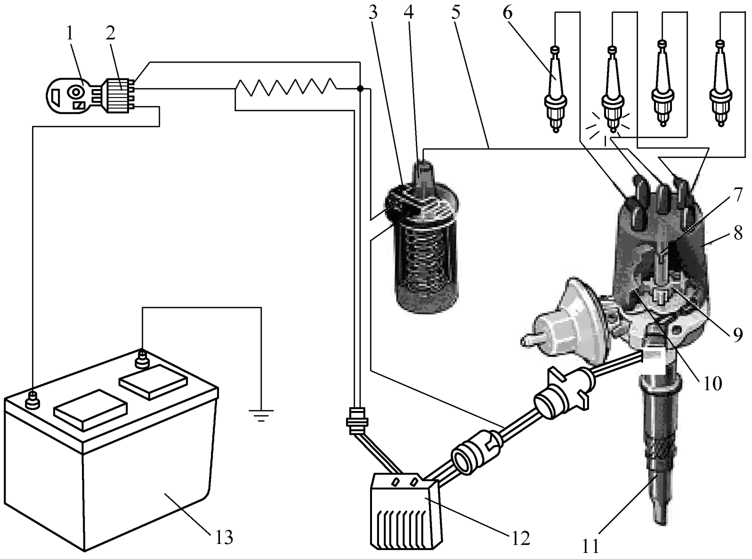


Fig. 2-6-1 Ignition system

1—ignition key 2—ignition switch 3—primary wire connector 4—ignition coil

5—jump spark wire 6—spark plug 7—distributor rotor

8—distributor rotor cap 9—time core 10—pick-up coil

11—distributor rotor shaft 12—ignition module 13—battery

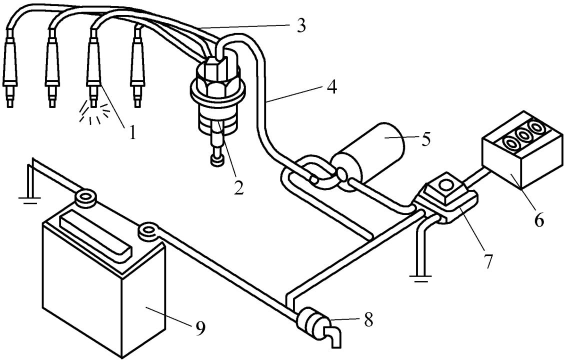


Fig. 2-6-2 Distributor ignition system

1—spark plug 2—distributor 3—high-voltage wire 4—center high-voltage wire

5—ignition coil 6—ECU 7—igniter 8—ignition switch 9—battery

from the ECM and generates sparks at the spark plug.

4) The ECM monitors the engine condition by signals from each sensor, calculates the ignition timing and sends an ignition signal to the igniter.

5) The ignition coil allows the generation of a high voltage sufficient to cause a spark to jump across the spark plug gap.

6) The distributor distributes high voltage to the spark plug of each cylinder in the specified ignition order. Fig. 2-6-3 shows parts of the distributor.

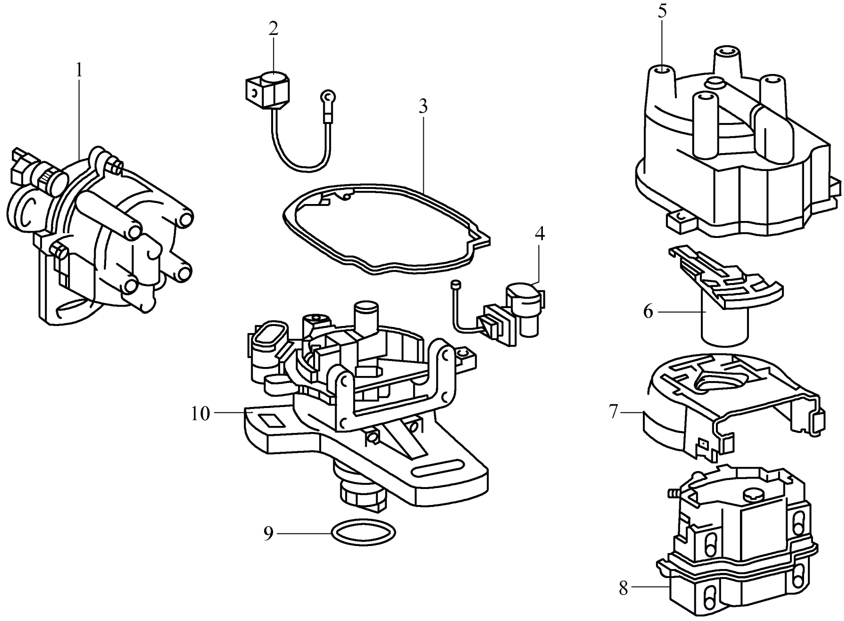


Fig. 2-6-3 Distributor

1—distributor 2—condenser 3—dust proof packing 4—distributor break lead
5—distributor cap 6—rotor 7—dust proof cover 8—ignition coil
9—O-ring 10—distributor housing

7) The spark plug wires are used to connect the high-voltage to each spark plug.

8) The spark plugs provide a gap within the combustion chamber so that each time a high-voltage is delivered, a high-quality spark will occur. See Fig. 2-6-4.

In the early 1990s, a new type of ignition system began to appear on many automobiles. It is called the distributorless ignition system, or direct ignition system. This system provides a high voltage spark at the spark plug without many of the secondary system parts. The system can provide higher voltages and does so with fewer parts to wear out. According to the distributorless ignition system, the ignition system can be classified double ignition and single ignition. The following is single ignition of distributorless ignition system. See Fig. 2-6-5.

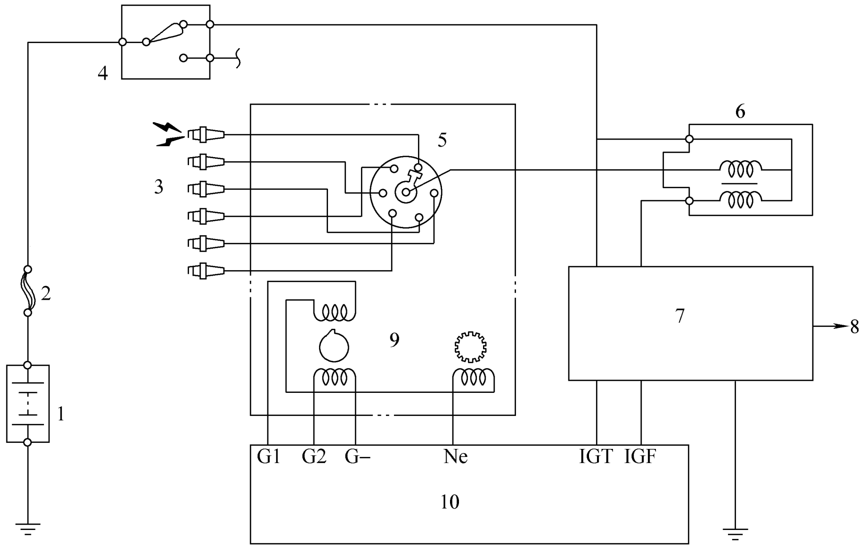


Fig. 2-6-4 Distributor ignition system circuit

1—battery 2—fuse wire 3—spark plug 4—ignition switch
5—distributor 6—ignition coil 7—igniter 8—to tachometer
9—crankshaft position sensor 10—ECU

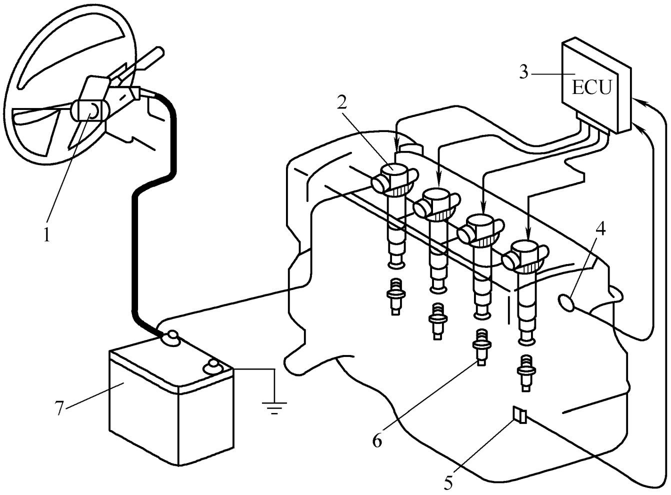


Fig. 2-6-5 The single ignition system

1—ignition switch 2—ignition coil 3—ECU 4—camshaft position sensor
5—crankshaft position sensor 6—spark plug 7—battery

New Words and Expressions

voltage	n.	电压，伏特
current	n.	电流，气流；adj. 当前的
alter	v.	改变
contact	n. /vt.	接触；联系
breaker	n.	断电器，继电器
semiconductor	n.	半导体
transistor	n.	晶体管
ground	n. /v.	接地，搭铁
positive	adj.	阳性的；肯定的；正的
temporarily	adv.	临时地
interrupt	vt.	打断；中断；妨碍
generation	n.	产生，发生
ignition system		点火系统
ignition switch		点火开关
ignition coil		点火线圈
ignition signal		点火信号
camshaft position sensor		凸轮轴位置传感器
crankshaft position sensor		曲轴位置传感器

Exercises

Ⅰ. Answer the following questions according to the text.

1. What’s the function of the ignition system?
2. What kinds the ignition system may be classified?
3. Please name the major parts that make up the conventional ignition system.
4. What are the spark plug wires used to do?

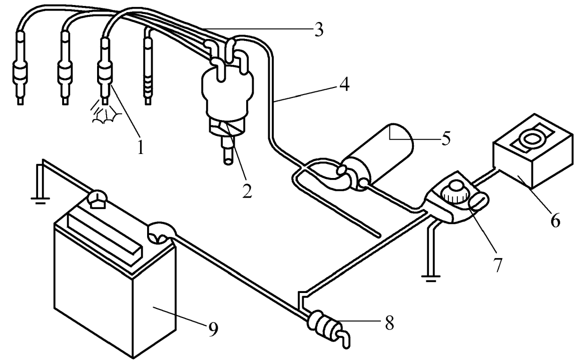
Ⅱ. Translate the following paragraph into Chinese.

To make the petrol engine work well, the function of the ignition system should fulfill the basic requirement of the gasoline engine:

1. The voltage of the ignition system should be high enough.
2. The power of the ignition system should be high enough.
3. The ignition time should be proper for the operation of the gasoline engine.

Nowadays, the electronic ignition system has replaced the conventional coil-ignition system.

Ⅲ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________ 5. ________

6. ________ 7. ________ 8. ________ 9. ________

Ⅳ. Abbreviations are very useful in practical work. Do you know the following English abbreviations you often come across in handling automotive materials? Read them and then translate them into corresponding Chinese terms.

1. CIS	conventional ignition system	________
2. EIS	electronic ignition system	________
3. ITDC	ignition top dead center	________
4. DLI	distributorless ignition	________
5. IT	ignition timing	________
6. C3I	computer controlled coil ignition	________
7. ICM	ignition control module	________
8. DFI	direct-fire ignition	________

Unit 7 Engine Starting System

The starting system is the heart of the electrical system in your car. The starting system performs this function by changing electrical energy from the battery to mechanical energy in the starting motor. This motor then transfers the mechanical energy, through gears, to the flywheel on the engine's crankshaft. During cranking, the flywheel rotates and the air-fuel mixture is drawn into the cylinders, compressed, and ignited to start the engine. Most engines require a cranking speed of about 200r/min. The starting system includes the following components: battery, cable and wires, ignition switch, starter solenoid or relay, starter motor, starter drive and flywheel ring gear. Fig. 2-7-1 is the components in a simplified cranking system circuit.

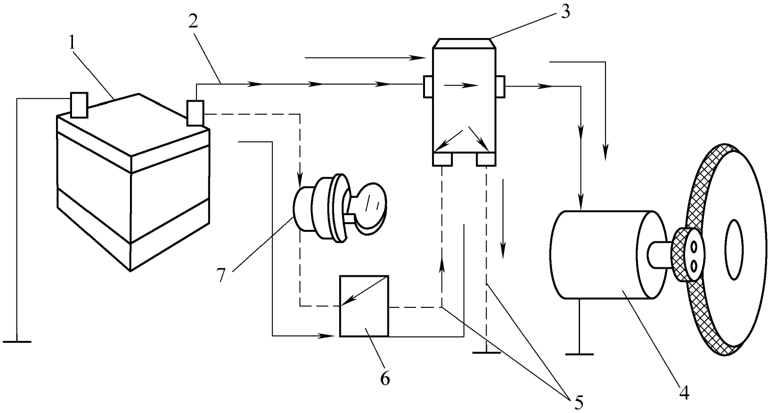


Fig. 2-7-1 Starting system

1—battery 2—starting circuit 3—magnetic switch 4—starter motor
5—control circuit 6—starting safety switch 7—ignition switch

The function of the starting system is to cranking the engine fast enough to allow the engine to start . The starting system and ignition system must work together for good engine starting.

The automotive battery serves as an energy "bank". It receives from the vehicle's charging system and stores it until needed. Then it provides the energy to most electrical systems on demand. The battery converts electrical energy into chemical energy during charging. It then converts it back into electricity during discharging.

The key switch, or ignition switch, controls the ignition circuit. It also controls the starting system and the power for the instruments and vehicle accessories.

The starter motor, or starter, is a compact but very powerful direct-current electric motor designed to crank the engine fast enough for it to start. It rotates a small gear called a pinion. A starter drive assembly connects the small pinion gear to the end of the starter motor. The pinion gear mashes with the ring gear on the engine's flywheel. When the driver turns the key switch, the starter motor drives the pinion gear, which drives the flywheel and cranks the engine. In starting motor, field coils in a starting motor is used to produce the poles. Armature in a starting motor is a rotational part that has many loops of wire with a commutator. Brushes are used to make electrical contact between the rotating armature and the stationary battery. Fig. 2-7-2 is the structure of the starter.

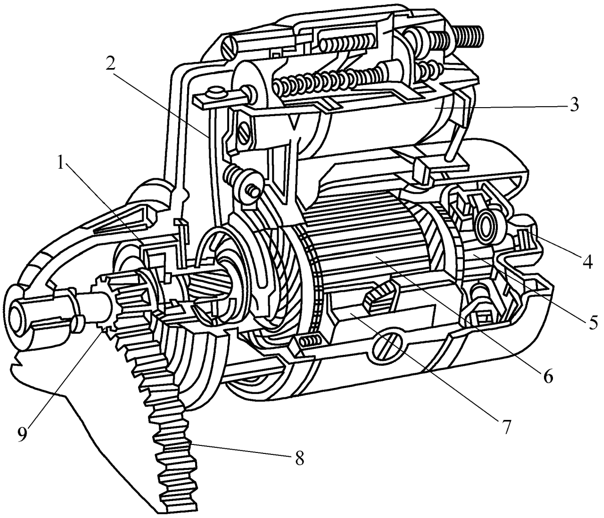


Fig. 2-7-2　The structure of the starter
1—over-running clutch　2—shift lever　3—solenoid　4—brush hold
5—commutator　6—motor armature　7—field coil
8—flywheel　9—pinion gear

The purpose of the starter clutch is to engage and disengage the pinion gear from the flywheel. When the starter is cranked, the pinion gear slides on the armature shaft and engages the flywheel. To avoid damaging the armature and the commutator, the starter drive assembly is designed to disengaged the pinion gear from the ring gear as soon as the engine begins to operate.

The solenoid is a magnetic switch mounted on top of the starter motor. It has two important functions: it controls the electrical circuit between the battery and starter motor, it shifts the pinion gear in and out of mesh with the ring gear.

New Words and Expressions

cable	n.	电缆
wire	n.	导线，金属线
cranking	vt.	摇动；起动，开动
crank	vt.	起动
charging	n.	充电，充气，进气
discharging	n.	卸料，输出，放电

instrument	n.	仪器，仪表，器具
solenoid	n.	电磁线圈，螺线管线圈
relay	n.	继电器
motor	n.	发动机；电动机
armature	n.	电枢(电极的部件)
commutate	n.	转向器，转接器
field	n.	场，电场；磁场
pole	n.	棒(柱,杆,极)；磁极；电极
disengage	v.	脱离，解除，分离

starting system	起动系
electrical energy	电能
mechanical energy	机械能
cranking speed	(发动机)起动转速
starting motor	起动机
starter solenoid/drive	起动机电磁线圈/驱动机构
starter relay	起动继电器
lock-type switch	锁止开关
starting safety switch	起动安全开关
cranking system circuit	起动系电路
gear reduction ratio	齿轮减速比

Exercises

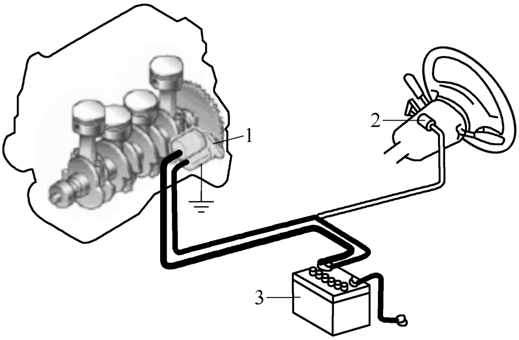
Ⅰ. Answer the following questions according to the text.

1. What’s the function of the starting system?
2. Please name the major parts that make up the conventional starting system.
3. Describe the work process of the starter motor.
4. What’s the function of the solenoid?

Ⅱ. Translate the following paragraph into Chinese.

The engine must be started by the external force. The function of the starting system is to convert the electrical energy of the battery into mechanical energy, produce torque and start the engine. The starter is widely used on modern vehicles, which can ensure the safe operation, quick and reliable starting and reduction of driving labor.

Ⅲ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________

Unit 8 Engine Lubrication System

The engine consists of various components, many of which are moving parts, such as the crankshaft and the camshaft rotating at a high speed, the piston making reciprocating rectilinear motion at a high speeding in the cylinder, the intake and exhaust valves making reciprocating rectilinear motion in the valve guide. All of the rotating parts need to be supported by the bearing, and all of the reciprocating parts need to be supported by the guiders. If there is metal friction between the supporting parts and moving parts , the metal surface will be worn soon no matter how hard it is. In addition, the metal expands because of the high temperature, which makes the air gap disappear between the supporting parts and moving parts so that has cohesive failure. So the components should be lubricated when the engine works. The function of the lubrication system is to make the oil circle to lubricate the components and make them play their full performance.

The engine lubrication system is designed to store, clean, and circulate engine oil throughout the engine.

The purpose of the lubrication system is to circulate oil between moving engine parts. Oil between the parts prevents metal-to-metal contact which causes friction and wear. The circulating oil has other important jobs. It carries heat away from engine parts, cleans engine parts, and helps the piston rings seal in compression pressures.

The parts and flow through the lubrication system are shown in Fig. 2-8-1.

1. Oil Pan

The oil pan is located on the bottom of the engine and holds the excess oil during

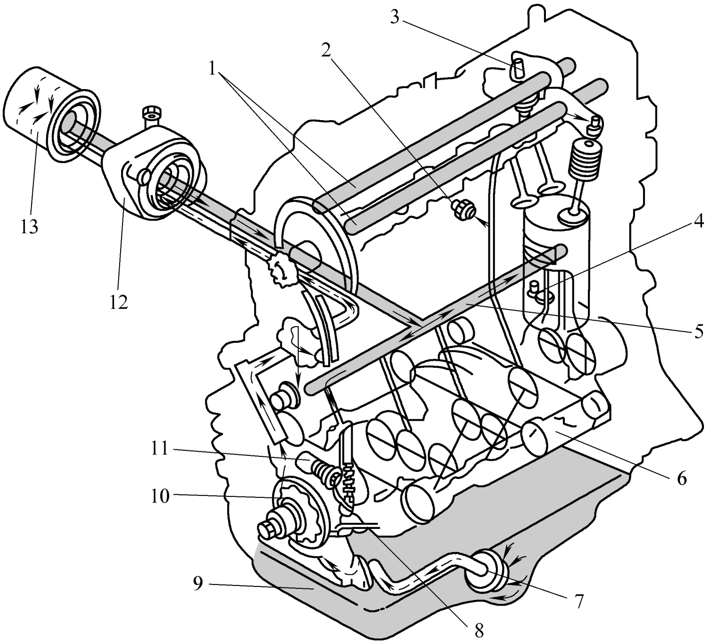


Fig. 2-8-1 The parts and flow through the lubrication system

1—rocker shaft 2—pressure switch 3—hydraulic tappet 4—piston cooling jet
5—main oil gallery 6—balance shaft 7—strainer 8—timing chain 9—oil pan
10—oil pump 11—relief valve 12—oil cooler 13—oil filter

operation and no running conditions. The pan also collects oil that runs off engine parts after lubrication. The deep part of the oil pan houses an oil pump and pick-up screen. A plug in the bottom of the oil pan is used to drain the oil at required intervals. Engines usually have an oil pan that holds 4, 5, or 6 quarts. A pick-up screen in the oil pan is connected by a pipe to the inlet of the oil pump. Oil pan and pick-up screen are shown in Fig. 2-8-2.

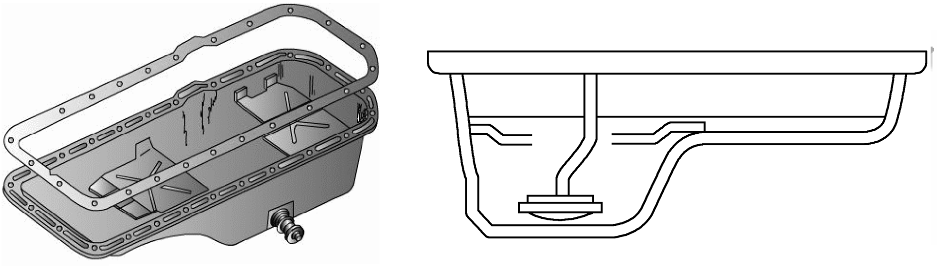

Oil pan
Pick–up screen

Fig. 2-8-2 Oil pan and pick-up screen

2. Oil Pump

The oil pump is located in the crankcase area so that oil can be drawn from the oil pan and sent into the engine. Most oil pumps have two small gears that mesh with each other. A pressure-regulator valve in the pump is used to prevent the lubrication system pressure from reaching too high. The oil pump pulls oil up from the oil pan through the pick-up screen. The screen collects any large particles of dirt so that the oil entering the pump is fairly clean. The pump then directs the oil through an oil filter, which strains any remaining dirt out of the oil; the oil entering engine lubrication passages should be clean.

3. Oil Pressure Relief Valve

Oil pressure relief valve is used to keep the pressure within the oil system at a constant maximum value.

4. Oil Filter

Oil filter (Fig. 2-8-3) is adopted to clean the dirt particles out of the lubricating system. As the oil and dirt flow the filter unit, contaminants are trapped inside the filter unit. It is changed when you change engine oil.

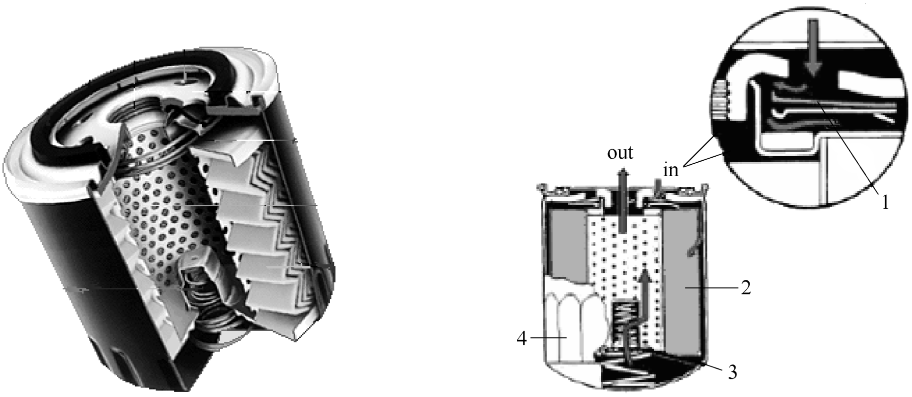


Fig. 2-8-3 Oil filter

1—check valve 2—element 3—relief valve 4—overflow valve

5. Oil Coolers

Oil temperature for an engine should be in certain range of degrees. Under normal conditions, oil is cooled by the right amount of oil in the oil pan. When excess temperatures occurs, such as some heavy-duty gasoline engines and many diesel engines, oil coolers are used to keep the oil cool.

6. Oil Pressure Sensors and Gauges

Oil pressure sensors are used to sense the oil pressure in the lubricating system.

Oil pressure is usually sensed directly from the main oil gallery. The value is sent to the dashboard on the vehicle and the operator can read it. The systems commonly used are a pressure gauge and an oil indicator light. The pressure gauge reads the oil pressure within the system. The oil pressure indicator light goes on when oil pressure is lower than a certain value. The Fig. 2-8-4 shows oil pressure switch and indicator light.

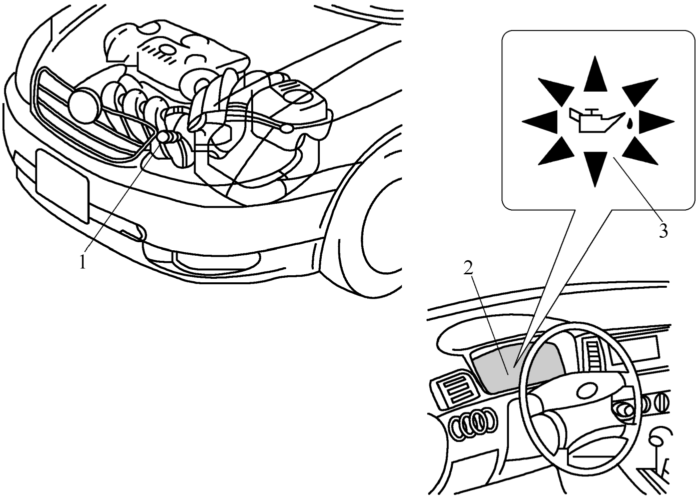


Fig. 2-8-4 Oil pressure switch and indicator light

1—oil pressure switch 2—instrument board 3—oil pressure indicator light

The Fig. 2-8-5 shows the lubrication oil tube.

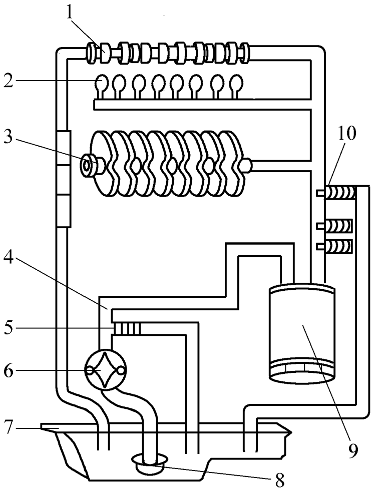


Fig. 2-8-5 The lubrication oil tube

1—camshaft 2—hydraulic tappet 3—crankshaft 4—main oil gallery/line 5—relief valve 6—oil pump 7—oil pan 8—oil screen 9—oil filter 10—by-pass valve

New Words and Expressions

lubrication	n.	润滑
lubricate	vt.	润滑，加润滑油
circulate	v.	循环
screen	n.	筛网，滤网
filter	n.	过滤器，滤油器
passageway	n.	通道，出入口
gallery	n.	通道，油道
relief	n.	卸荷；减压；释放
particle	n.	粒子，微粒
sense	vt.	感到，感觉
dashboard	n.	汽车等的仪表板，挡泥板
gauge	n.	量规；仪表，量表

lubrication system	润滑系统
moving component	运动部件
circulating oil	循环机油(润滑油)
compression pressure	压缩压力
pick-up screen	集滤器
at required interval	在规定时间
pressure-regulator valve	压力调节阀
oil filter	机油滤清器
lubrication passage	润滑油道
bypass valve	旁通阀
relief valve	泄压阀
oil pressure switch	油压开关
main oil gallery	主油道
oil indicator light	机油压力指示灯
pressure gauge	压力表

Exercises

Ⅰ. Answer the following questions according to the text.

1. What’s the function of the lubrication system?
2. Please name the major parts that make up the lubrication system.

3. What’s the function of the oil filter?

4. Engines are lubricated in three ways, what are they?

Ⅱ. Translate the following sentences into Chinese.

1. Engines are lubricated in three ways: pump pressure, splashing, or a combination of both.

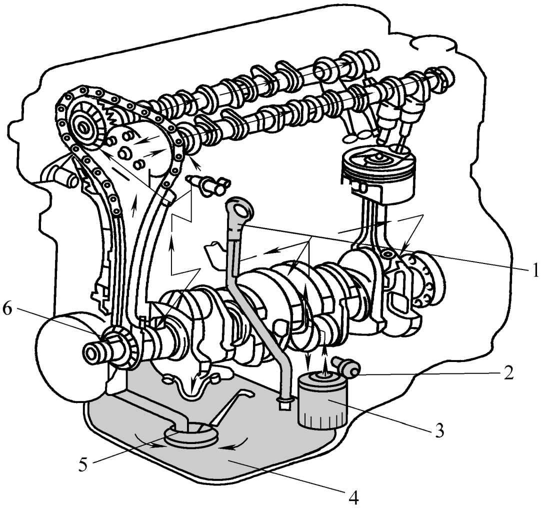
2. The engine lubrication system supplies oil to all the friction surfaces between the engine moving parts.

3. The purpose of the lubrication system is to circulate oil between moving engine parts .

4. The engine lubrication system is designed to store, clean, and circulate engine oil throughout the engine.

5. Finally, oil circulated on the cylinder walls seals the rings, improving the engine’s compression .

Ⅲ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________

4. ________ 5. ________ 6. ________

Unit 9 Engine Cooling System

Internal combustion engines must maintain a stable operating temperature, neither too hot nor too cold. A great deal of heat is produced in the engine by the burning of the air-fuel mixture. Some of this heat escapes from the engine through the exhaust gases (the hot gases left after the gasoline is burned), but enough remains in the engine. The engine can't work regularly if it can't cooling itself properly. The cooling system takes care of this additional heat.

The purpose of the engine's cooling system is to remove excess heat from the engine, to keep the engine operating temperature at its most efficient level, and to get the engine up to the correct temperature as soon as possible after starting. A cooling system is also required to prevent the internal engine parts from melting from the heat of the burning fuel. See Fig. 2-9-1.

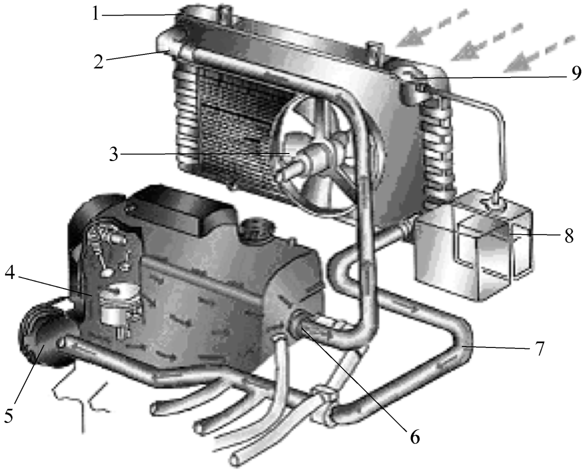


Fig. 2-9-1 The cooling system

1—radiator 2—upper Hose 3—fan 4—coolant 5—water pump
6—thermostat 7—lower Hose 8—fluid reservoir 9—radiator cap

The cooling system is built into the engine. There are hollow spaces around each engine cylinder and combustion chamber. These hollow spaces are called water jackets, since they are filled with water. When the engine is running, the water takes heat from the engine, becoming hot in the process. A water pump pumps the hot water from the engine water jackets into the radiator. The radiator has two sets of passages. One set carries water, the other set carries air (pulled through by car motion and the engine fan). As the hot water passes through, it gives up its heat to the air passing through. The cooled water then reenters the engine, where it can pick up more heat. In operation, water continuously circulates between the engine and the radiator, carrying heat from the engine to the radiator. By this means, excessive engine temperatures are prevented.

Sketch of simple circulating of cooling system is shown in Fig. 2-9-2.

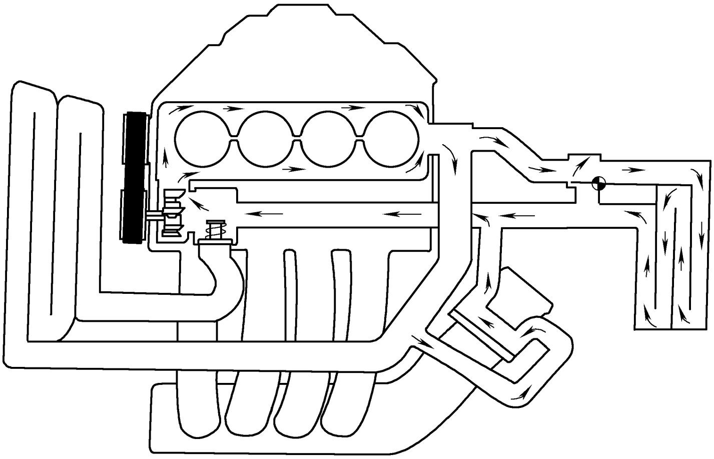
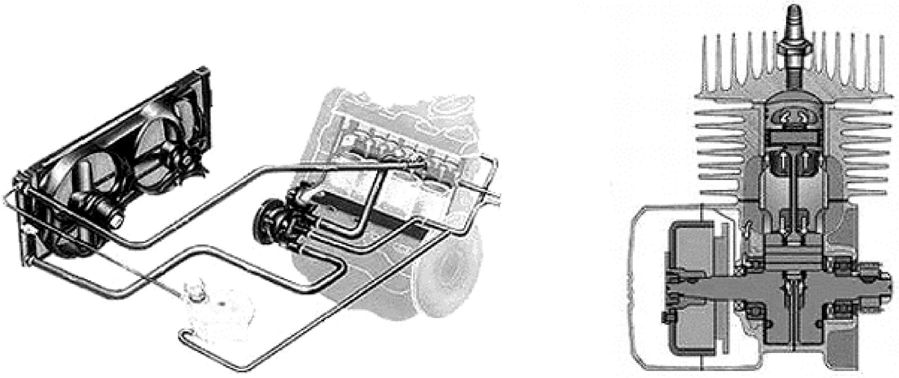


Fig. 2-9-2 Sketch of simple circulating of cooling system

Generally speaking, there are two kinds of cooling system: the liquid-cooled system and the air-cooled system. Fig. 2-9-3 shows the cooling types of engine. Nowadays, almost all kinds of the engines are using liquid-cooled system. The liquid-cooled system consists of water pump, water jackets, engine fan, radiator, thermostat hoses and other components .



Liquid-cooled system

Air-cooled system

Fig. 2-9-3 The cooling types of engine

1. Water Pump

The water pump is used to circulate the coolant through the cooling system. See Fig. 2-9-4. It is mounted on the front of the cylinder block and driven by a timing belt. Coolant passages in the engine are connected to the pump. A drive belt from a crankshaft pulley is connected to the coolant pump. When the engine is running, the crankshaft turns the drive belt. The hot coolant is pumped out of the engine and through a heat exchanger, that is, a radiator.

2. Water Jacket

The water jacket is the open spaces within the cylinder block and cylinder head through which coolant passes.

3. Radiator and Fan

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and it is mounted in the front of the vehicle. A fan is mounted behind the radiator to assist the flow of air through the radiator. Radiator consists of radiator core, lower tank and upper tank. The fan operates when the engine coolant temperature becomes high in order to prevent it from becoming too high. See Fig. 2-9-5.

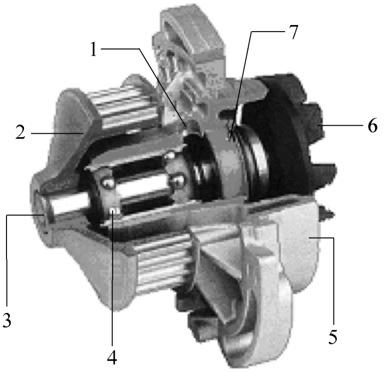


Fig. 2-9-4 The structure of water pump

1—drain hole 2—water pump belt

3—water pump shaft 4—bearing

5—coolant pump body 6—pump impeller

7—coolant pump seal

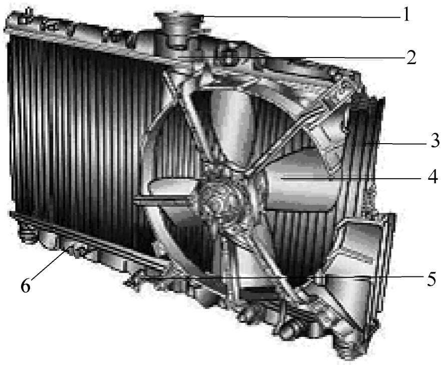


Fig. 2-9-5 Radiator

1—radiator cap 2—upper tank

3—radiator core 4—fan

5—coolant drain plug

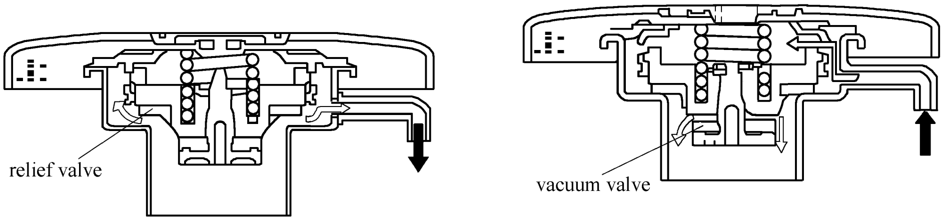
6—lower tank

4. Radiator Cap

A relief valve(pressurization valve)and a vacuum valve(negative pressure valve) are built into the radiator cap. It is used to maintain the correct and constant pressure on the cooling system. Pressure valve gives the coolant pressure. When the temperature of the coolant up to 100℃, there is a great difference in temperature so that it can cool the engine more efficiently.

With the pressure rising, pressure valve opens and sends the coolant back to reserve tank.

With the pressure dropping, vacuum valve opens and the coolant flows out. See Fig. 2-9-6.



With the pressure rising,
the temperature is going up.

With the pressure dropping,
the temperature is declining.

Fig. 2-9-6 Radiator cap

5. Thermostat

The thermostat is one of the most important parts of the cooling system. Thermostat controls the moving direction of coolant and is used to keep the engine coolant at the most efficient temperature. If the coolant remains cold, it will be closed. In this case, a large amount of coolant goes to the by-pass tube without being cooled. The remaining coolant passes through the radiator to be cooled. If the coolant temperature rises to the opening point, the thermostat opens slightly. As the temperature increases further, the thermostat opens more. When the engine is under full load, the thermostat will be fully open. The maximum amount of coolant will be sent to the radiator for cooling, and a small amount will continue to flow through the by-pass tube. See Fig. 2-9-7.

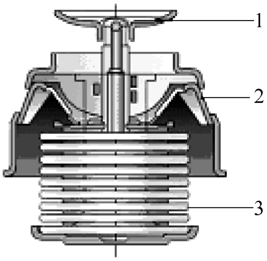
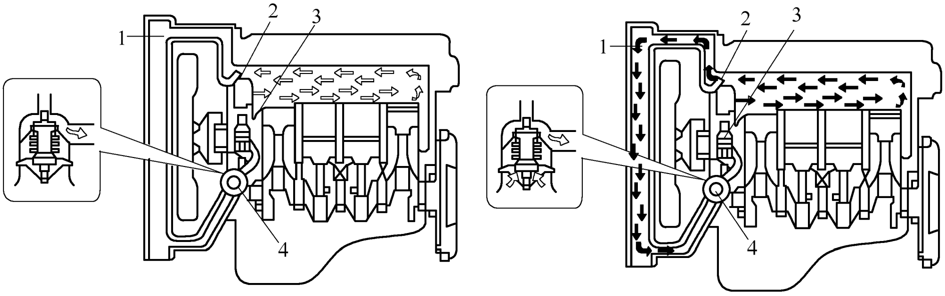


Fig. 2-9-7 Thermostat

1—main valve 2—side valve 3—expansion extinguishers

Under the thermostat's controlling, there are two flowing routes in the cooling system, large circle and small circle. In the small circle condition, the temperature of the coolant is low, the thermostat prevents the coolant from going through the radiator. In the large circle condition, the temperature of the coolant is too high, Thermostat makes the coolant go through the radiator to cool it. See Fig. 2-9-8.



Small circle

Large circle

Fig. 2-9-8 The coolant circulating routes

1—radiator 2—side route 3—water pump 4—thermostat

New Words and Expressions

coolant	n.	冷却液，冷却剂
cooler	n.	冷却器
removal	n.	动，消除
excess	adj.	过度的，过剩的，过量的
fin	n.	(散热器)冷却片
fan	n.	风扇
thermostat	n.	节温器，恒温器
jacket	n.	(水、护)套，(保护)罩
radiator	n.	散热器，水箱
hose	n.	软管
load	n.	负荷；装载量；负载，加载；v. 装载

operating temperature	工作温度
liquid-cooled	液冷式，液体冷却式
air-cooled	风冷式，空气冷却式
circulating fluid	循环流体
heat exchanger	热交换器
coolant pump	水泵，冷却液泵
radiator hose	散热器软管
radiator pressure cap	散热器盖
coolant recovery system	冷却液回收系统
coolant passage	冷却液通路
center core	散热器芯

Exercises

Ⅰ. Answer the following questions according to the text.

1. What's the function of the cooling system ?
2. Please name the major components that make up the water-cooling system .
3. What's the function of the radiator ?
4. What does a water-cooling system mean ?

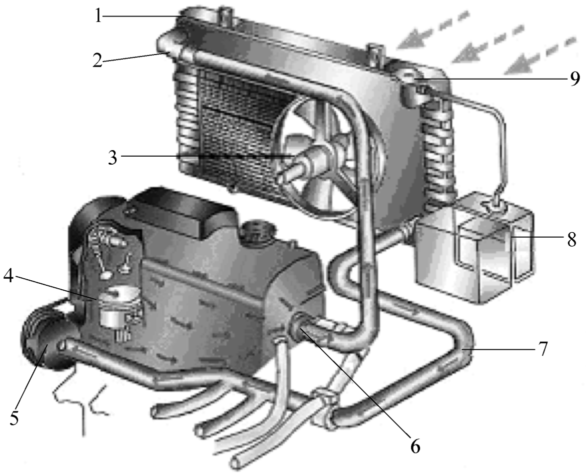
Ⅱ. Translate the following passage into Chinese.

As fuel is burning in the engine, about one-third of the energy in the fuel is converted into power. Another third goes out through the exhaust pipe unused, and the remaining third must be handled by the cooling system. This means that the engine can work effectively only when the heat energy is equally handled so as to keep the engine temperature in balance.

Ⅲ. Read Abbreviations and then translate them into corresponding Chinese terms.

1.	LO	lubrication oil	________
2.	CC	coolant control	________
3.	LLC	long life coolant	________
4.	OLB	oil-lubricated bearing	________
5.	ODI	oil drain intervals	________

Ⅳ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________ 5. ________
6. ________ 7. ________ 8. ________ 9. ________

Chapter Three　Chassis

Unit 1　Power Train System

The power train serves two functions: it transmits power from the engine to the drive wheels, and it varies the amount of torque. The power train system can be classified as FF, FR, MR, four-drive(4WD) and so on. FF and FR are widely used on vehicles. MR is mainly used on racers. 4WD is mainly used in cross-country vehicles and luxury sedan. See Fig. 3-1-1, Fig. 3-1-2 and Fig. 3-1-3.

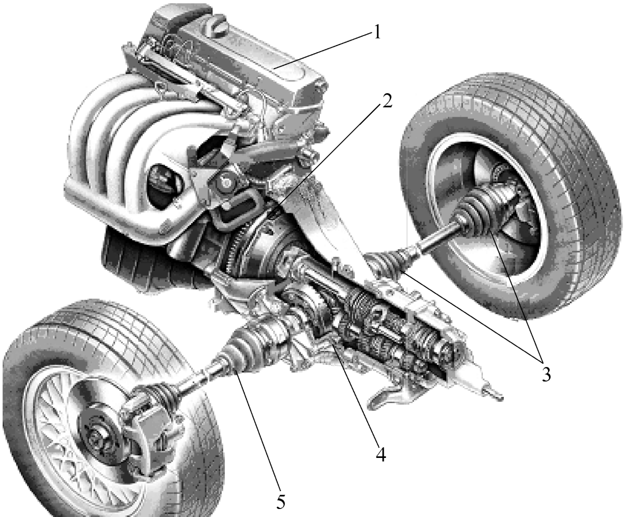


Fig. 3-1-1　The components of FF power train system

1—engine　2—clutch　3—drive shaft cover　4—transaxle　5—drive shaft

The power train includes:

1) engine: that produces power.

2) transmission: either manual or automatic.

3) clutch: used only on manual transmission, or torque converter used only on automatic transmission.

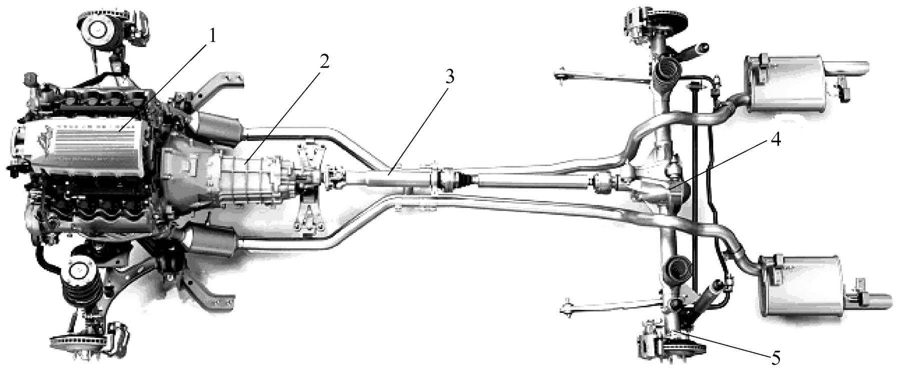


Fig. 3-1-2 The components of FR power train system

1—engine 2—transmition 3—drive shaft 4—rear-axle 5—half shaft

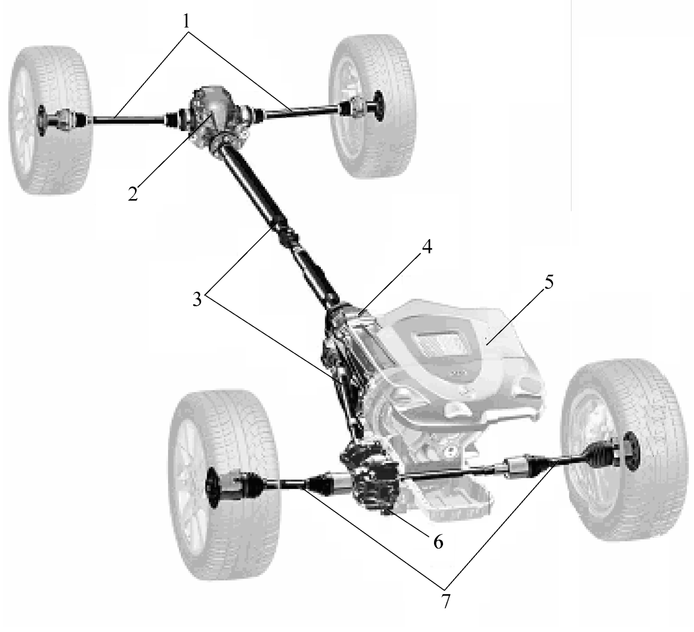


Fig. 3-1-3 The components of 4WD power train system

1—rear half shaft 2—rear-axle 3—drive shaft 4—transmission

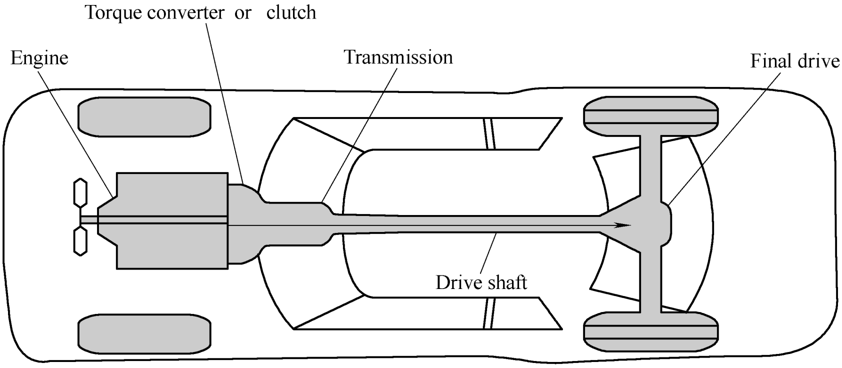
5—engine 6—front differential 7—half front axle

4) drive shaft: that transmits the power from transmission to differential.

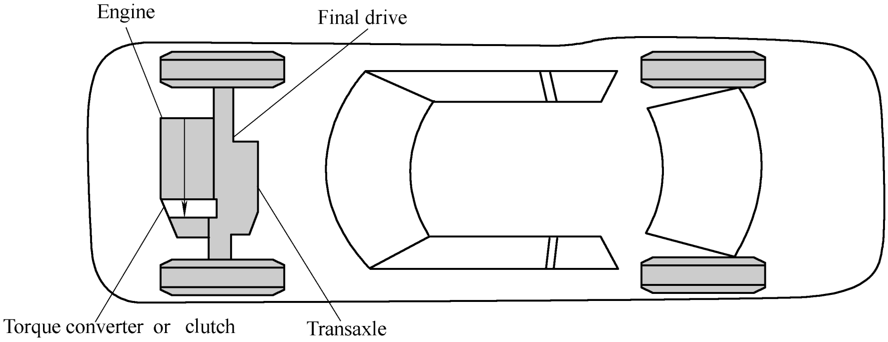
5) differential: that carries the power to the two wheel axles. See Fig. 3-1-4.

1. Manual Transmission

Although modern automatic transmissions used on automotive vehicles vary in details, they all operate in a similar manner.



Rear wheel drive layout



Front wheel drive layout

Fig. 3-1-4 Power train arrangement

The function of a manual transmission, shown in Fig. 3-1-5 is to transfer engine power to the drive shaft and rear wheels. The transmission provides different gear ratios between the engine and wheels. This is necessary with the gasoline engine, since the engine produces little power at low speed. Thus, for accelerating the car from a standing start, considerable power is required; the engine should be running at a fairly high speed. The driver, therefore, shifts the transmission gears into first; this gear position permits the engine to run at a fairly high speed. A typical first-gear ratio would be that the engine shaft turns 12 times to turn the rear wheel once. Thus, the engine develops high power, and the car moves away from the curb and accelerates quickly. In second, the car accelerates to a higher speed and the typical ratio would be 8∶1. In third, a typical ratio would be 1∶1.

Manual transmissions usually have four or five speeds, and often have "overdrive", which means that the output shaft can turn faster than the input shaft for fuel economy on the highway. When you use it, it will reduce the engine speed by one-third, while maintaining the same road speed. See Fig. 3-1-6.

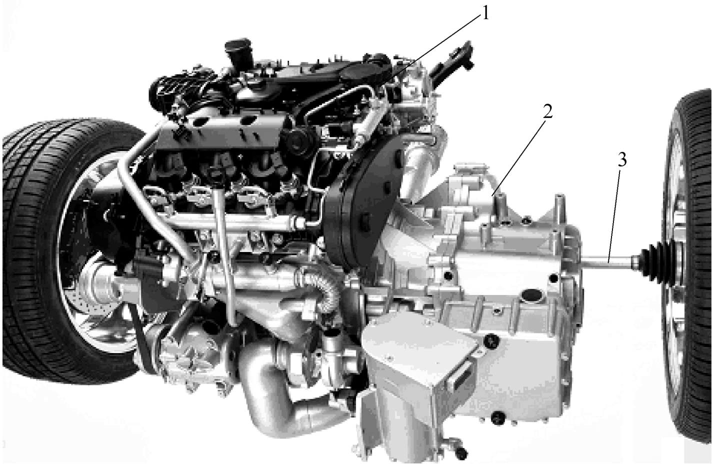
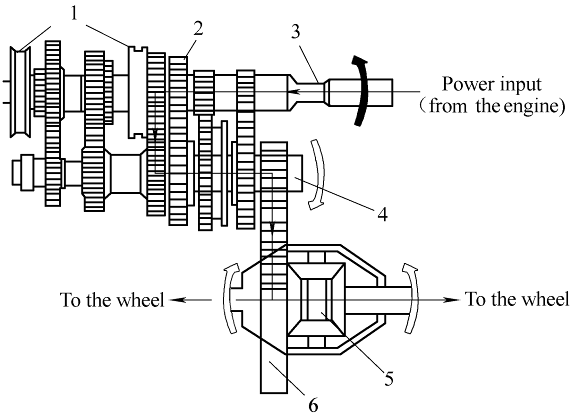


Fig. 3-1-5 The position of the transmission(FF)

1—engine 2—transmission 3—drive shaft



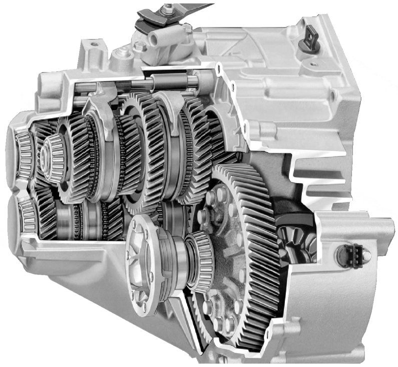


Fig. 3-1-6 The Structure of the transmission

1—synchronizer 2—speed-change gear 3—input shaft 4—out-put shaft

5—differential assembly 6—final gear

2. Automatic Transmission

Both an automatic transmission and a manual transmission accomplish exactly the same thing. In automatic transmissions, the varying ratios between the engine crankshaft and the wheels are achieved by automatic means. That is, the driver does not need to shift gears because the automatic controls on the automatic transmission supply the proper ratio to suit the driving conditions.

Automatic transmissions are used in many rear-wheel-drive and four-wheel-drive vehicles. Automatic transaxles are used in most front-wheel-drive vehicles. The major components of a transaxle are the same as those in a transmission, except the transaxle assembly includes the final drive and differential gears, in addition to the transmission.

An automatic transmission receives engine power through a torque converter, which is driven by the engine's crankshaft. Hydraulic pressure in the converter allows power to flow from the torque converter to the transmission's input shaft. The input shaft drives a planetary gear set that provides the different forward gears, a neutral position, and one reverse gear. Power flow through the gears is controlled by multiple-disk clutches, one-way clutches, and friction bands. See Fig. 3-1-7, Fig. 3-1-8, Fig. 3-1-9.

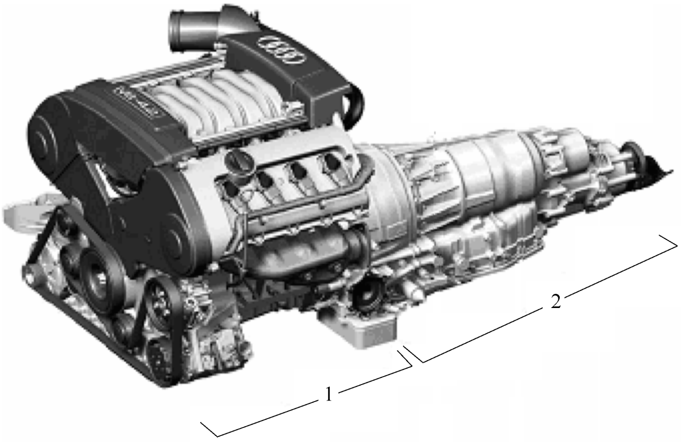


Fig. 3-1-7 The position of the automatic transmission(FR)

1—engine 2—automatic transmission

3. Clutch

The clutch is located in the power train between the engine and the transmission. The function of the clutch when used in an automotive application is to connect or disconnect the power from the engine's crankshaft with or from the gearbox and transmission.

Driving a car with a manual transmission, the driver depresses the clutch, selects a gear, and releases the clutch while applying power to get the car to move. The clutch allows engine power to be applied gradually when a vehicle is starting out, and interrupts power to avoid gear crunching when shifting. Engaging the clutch allows power to transfer from the engine to the transmission and drive wheels. Disengaging the

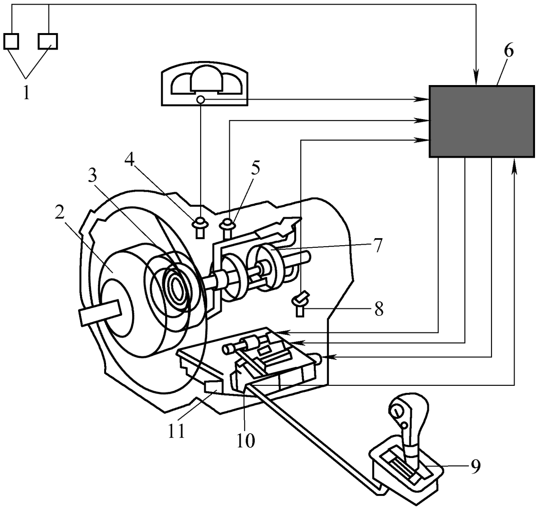


Fig. 3-1-8 The components of the automatic transmission

1—sensor 2—torque converter 3—oil pump 4—speed sensor

5—counter gear speed sensor(output) 6—ECU 7—planetary gear

8—turbine speed sensor(input) 9—change lever

10—hydraulic control unit 11—magnet valve

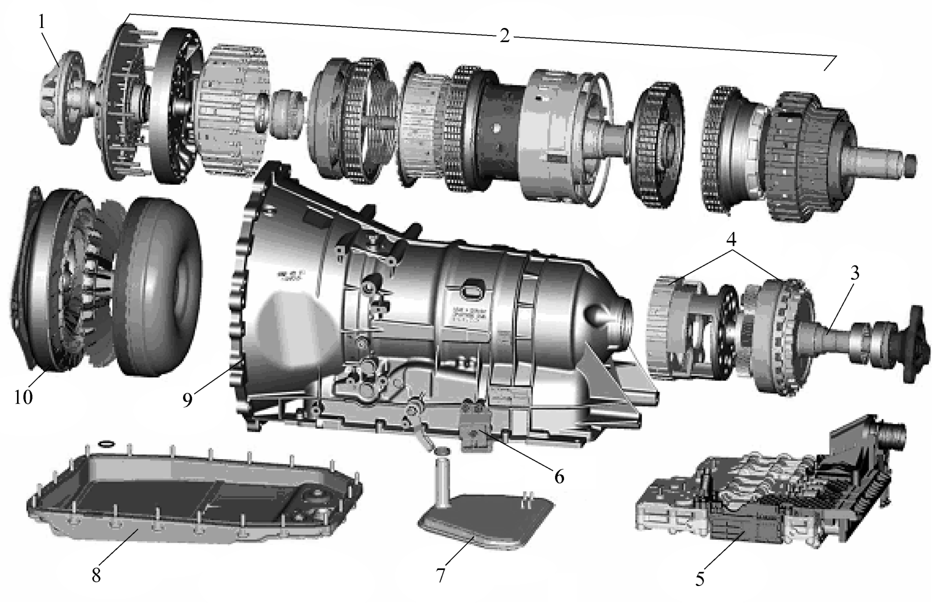


Fig. 3-1-9 The internal structure of the automatic transmission

1—oil pump 2—clutch and arrester parts 3—output shaft 4—planetary gear

5—main valve body 6—shift position console switch 7—oil filter

8—oil pan 9—transmission housing 10—torque converter clutch stops the power transfer and allows the engine to continue turning without force to the drive wheels.

The major components of the clutch include the flywheel, clutch disk, cover assembly, pressure plate, release bearing and clutch linkage. See Fig. 3-1-10, Fig. 3-1-11, and Fig. 3-1-12.

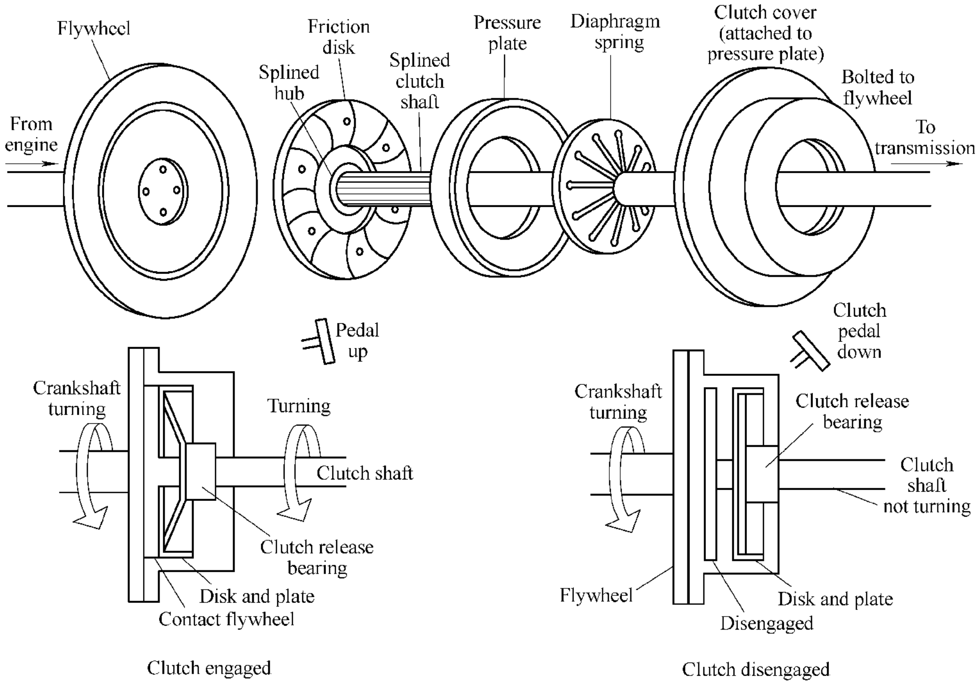


Fig. 3-1-10 Clutch

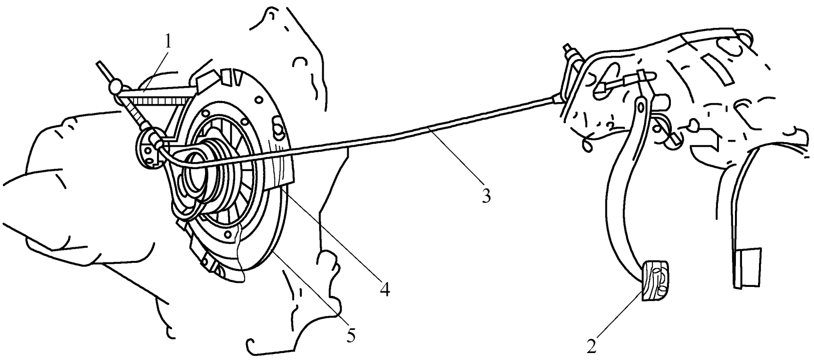


Fig. 3-1-11 Cable clutch

1—clutch fork 2—clutch pedal 3—cable 4—pressure plate 5—clutch disc

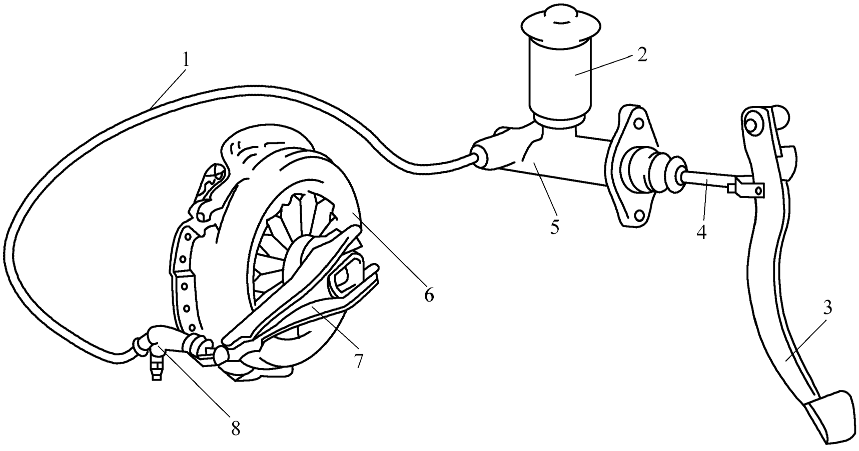


Fig. 3-1-12 The components of the hydraulic assistance clutch

1—hydraulic line 2—reservoir tank 3—clutch pedal 4—push rod

5—clutch master cylinder 6—clutch 7—release fork 8—slave cylinder

The flywheel is bolted to the crankshaft of the engine. Its main function is to transfer engine torque from the engine to the transmission.

The clutch disk is basically a steel plate, covered with a frictional material that goes between the flywheel and the pressure plate.

A pressure plate is bolted to the flywheel. It includes a sheet metal cover, heavy release springs, a metal pressure ring that provides a friction surface for the clutch disk.

The release bearing is the heart of clutch operation. When the clutch pedal is depressed, the throw-out bearing moves toward the flywheel, pushing in the pressure plate's release fingers and moving the pressure plate fingers or levers against pressure plate spring force.

The clutch cover assembly contains the pressure plate, springs, and other parts according to the design of the clutch. The cover is bolted to the flywheel and rotates with it at crankshaft speed.

The linkage transmits and multiplies the driver's leg force to the fork of the clutch pressure plate.

4. Torque Converter

The key to the modern automatic transmission is the torque converter. It takes the place of a clutch in a manual transmission to send the power from the engine to the transmission input shaft. The torque converter offers the advantage of multiplying the turning power provided by the engine.

It has three parts that help multiply the power: an impeller (or pump) connected to the engine's crankshaft, a turbine to turn the turbine shaft which is connected to the gears, and a stator (or guide wheel) between the two. See Fig. 3-1-13.

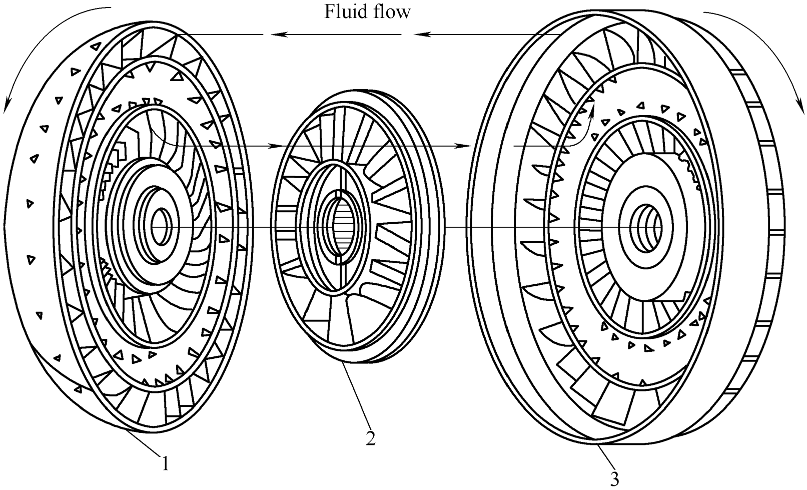


Fig. 3-1-13 The components of torque converter

1—turbine 2—stator 3—impeller

The torque converter is filled with transmission fluid that is moved by the impeller blades. The stator's vanes catch the oil thrown off from the impeller, and use it to move the turbine's blades. When the impeller spins above a certain speed, the turbine spins, driven by the impeller.

5. Planetary Gearing

Planetary gears provide for the different gear ratios needed to move a vehicle in the desired direction at the correct speed. A planetary gear set consists of a sun gear, planet gears, and a internal ring. See Fig. 3-1-14.

In the center of the planetary gear set is the sun gear. Planet gears surround the sun gear, just like the earth and other planets in our solar system. These gears are mounted and supported

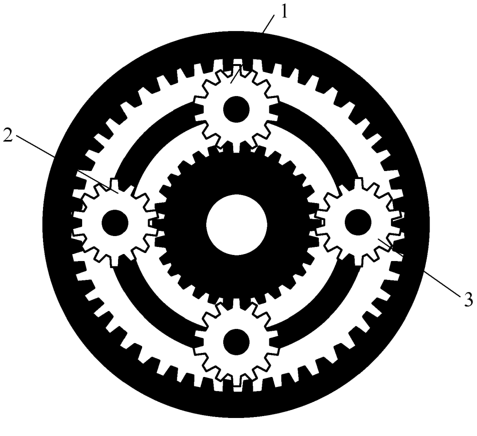


Fig. 3-1-14 Planetary gear set

1—planet gear and carrier 2—sun gear 3—internal ring by the planet carrier and each gear spins on its own separate shaft. The planet gears are in constant mesh with the sun and ring gears.

The planetary gear set can provide a gear reduction or overdrive, direct drive or reverse, or a neutral position.

6. Differential

On FWD cars, the differential unit is normally part of the transaxle assembly. On RWD cars, it is part of the rear axle assembly. Located inside the differential case are the differential pinion shafts and gears and the differential side gears. See Fig. 3-1-15.

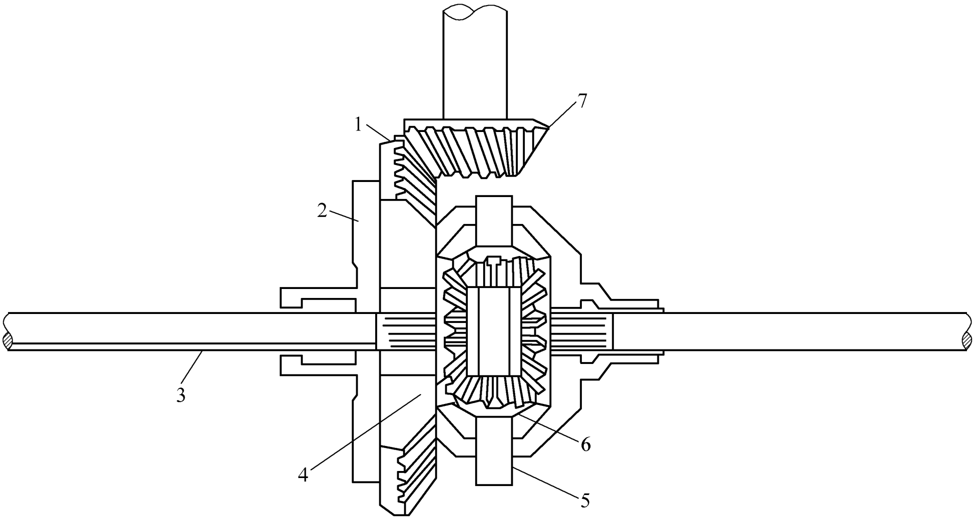


Fig. 3-1-15 Basic differential

1—ring gear 2—differential case 3—axle

4—differencial side gear 5—shaft

6—pinion gear 7—drive pinion

The differential assembly revolves with the ring gear. Axle side gears are splined to the rear axle or front axle drive shafts, which includes the differential, rear axles, wheels, and bearings.

If the car were to be driven in a straight line without having to make turns, then no differential would be necessary. However, when the car rounds a turn, the outer wheel must travel farther than the inner wheel. The differential permits the two rear wheels to rotate different amounts when the car goes around a turn, while still delivering power to both rear wheels. See Fig. 3-1-16 and Fig. 3-1-17.

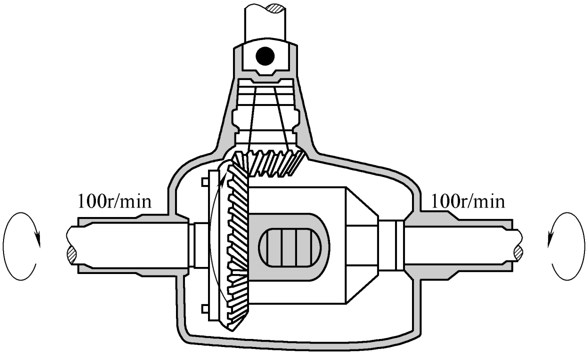


Fig. 3-1-16　A car is moving straight

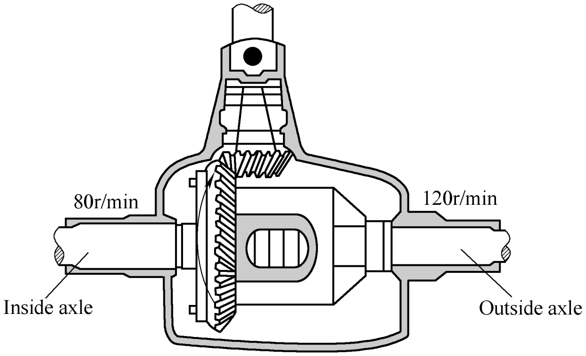


Fig. 3-1-17　A car turns a sharp corner

New Words and Expressions

vary	vt.	改变，变更
transmission	n.	变速器
manual	adj.	手的，手动的
automatic	adj.	自动的　　n. 自动装置
clutch	n.	离合器
differential	n.	差速器
axle	n.	轮轴，车轴
transfer	vt.	传递，传导
gear	n.	齿轮，传动装置
transaxle	n.	驱动桥(与变速器连成一体,用于前轮驱动的汽车)
depress	vt.	压下

interrupt	vt.	中断
engage	vt.	接合，啮合
disengage	v.	脱离啮合
linkage	n.	联接
frictional	adj.	摩擦的，摩擦力的
bolt	v.	螺栓固定
accomplish	vt.	完成，达到，实现
achieve	vt.	完成，获得
planetary	adj.	行星的
component	n.	部件，零件
shift	vt.	变速，换档
gearshift	n.	变速杆，换档
reverse	n.	倒档
neutral	n.	空档
park	n.	驻车档
deceleration	n.	减速

drive wheel	驱动轮
manual transmission	手动变速器
torque converter	液力变矩器
automatic transmission	自动变速器
manual transaxle	自动变速驱动桥
front-wheel-drive(FWD)	前轮驱动
rear-wheel-drive(RWD)	后轮驱动
four-wheel-drive(4WD)	四轮驱动
planetary gear set	行星齿轮组
transaxle assembly	驱动桥总成
final drive	主减速器
differential gear	差速器
multiple-disc clutches	多盘式离合器
one-way clutch	单向离合器
manual transmission	手动变速器
clutch pedal	离合器踏板
release bearing	分离轴承
torque converter	液力变矩器

impeller blade	泵轮叶片
sun gear	太阳轮
plane gear	行星齿轮
ring gear	齿圈
gear reduction radio	齿轮减速比
transaxle assembly	驱动桥总成
rear axle assembly	后桥总成
rear axle drive shaft	后桥驱动轴
front axle drive shaft	前桥驱动轴
drive shaft	驱动轴

Exercises

Ⅰ. Answer the following questions according to the text.

1. What's the function of the power train?
2. What's the function of a manual transmission ?
3. What are the three elements of a planetary gear set ?
4. Please describe the principle of the torque converter.

Ⅱ. Translate the following passage into Chinese.

The power train includes：（1）engine：that produces power；（2）transmission：either manual or automatic；（3）clutch：uses only on manual transmission，or torque converter：used only on automatic transmission；（4）drive shaft：that transmits the power from transmission to differential；（5）differential：that carries the power to the two wheel axles.

Ⅲ. Read Abbreviations and then translate them into corresponding Chinese terms.

1.	FWD	front-wheel-drive	________
2.	RWD	rear-wheel-drive	________
3.	4WD	four-wheel-drive	________
4.	PO	power output	________
5.	PCM	power-train control module	________
6.	PTU	power transfer unit	________

Unit 2　Brake System

Stopping of the vehicle is as necessary as its starting. Once the vehicle is started, it must be stopped somewhere. Brake are applied on the wheel to stop the vehicle.

The brake system is the most important system to the vehicle. The function of the brake system is to slow down or bring to rest a moving vehicle in a shortest possible distance, or to hold the vehicle stationary if already halted. If the brakes don't work properly, the result can be disastrous. So good brake system are essential for safety.

There are two kinds of brake systems: service brake system and parking brake system. A service brake system can slow down or even stop the car that is running at a high speed and guarantee the safety of passengers. It is foot-operated by the driver depressing and releasing the brake pedal. A parking brake system can prevent the auto slipping away from its parking place, even if it is parked on a steep slope. It is also called the hand brake.

Basically, all car brakes are friction brakes. When the driver applies the brake, the control device forces brake shoes, or pads, against the rotating brake drums or disks at wheel. Friction between the shoes or pads and the drums or disks then slows or stops the wheels so that the car is braked. The principle of braking as shown in Fig. 3-2-1.

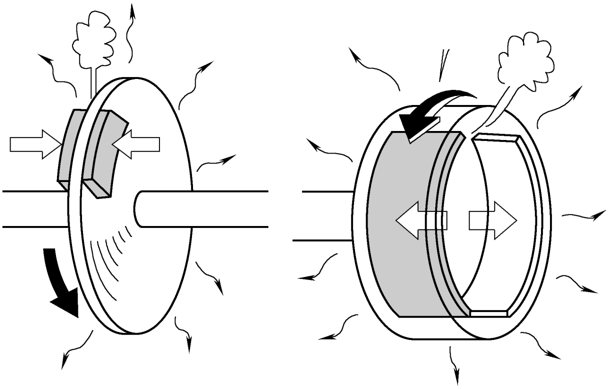
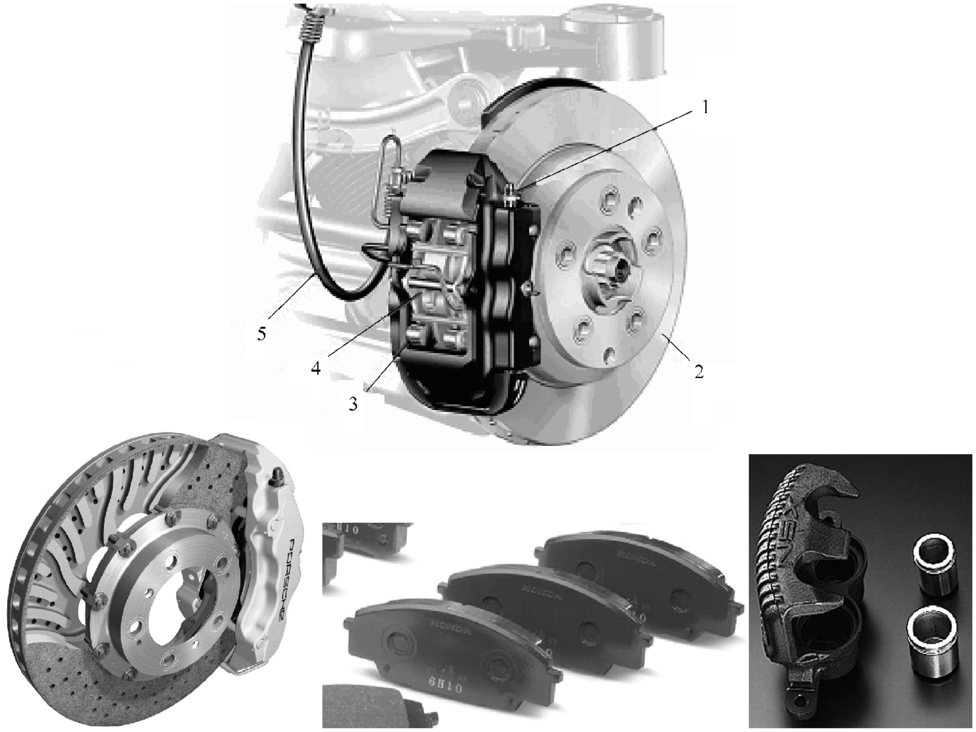


Fig. 3-2-1 The principle of braking

The disk brake is the best brake we have found so far. In recent years, brakes have changed greatly in design. Disk brakes, used for years for front wheel applications, are fast replacing drum brakes on the rear wheels of modern cars. This is generally due to their simpler design, lighter weight and better braking performance. The greatest advantage of disk brake is that it provides significantly better resistance to "brake fade" compared to drum type braking system.

The main components of a disk brake are: brake pads, caliper(which contains a piston)and disk or rotor(which is mounted to the hub). See Fig. 3-2-2.

If disk brakes are so great, how come we still have cars with drum brakes? The



Brake disk　Brake pads　Brake caliper

Fig. 3-2-2　Erection diagram and components of disk brake

1—bleed screw　2—brake disc　3—brake caliper　4—brake pads　5—brake pipe

reason is cost. While all vehicles produced for many years have disk brakes on the front, drum brakes are cheaper to produce for the rear wheels. The main reason is the parking brake system. Drum brakes consist of a backing plate, brake shoes, brake drum, wheel cylinder, return springs and an automatic or self-adjusting system. See Fig. 3-2-3.

The typical brake system is composed of the following basic components:

1) Master cylinder: that is located under the hood, and is directly connected to the brake pedal, converts your foot's mechanical pressure into hydraulic pressure.

2) Brake lines and brake hoses: they connect the master cylinder to the wheel cylinders located at each wheel.

3) Brake fluid: that is specially designed to work in extreme conditions and fills the system.

4) Shoes and pads: they are pushed by the wheel cylinders to contact the drums or

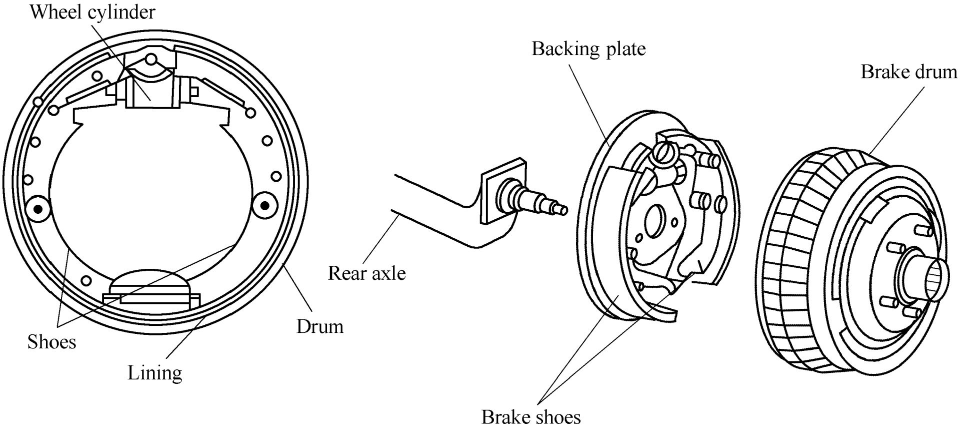


Fig. 3-2-3　Drum brake

disks thus causing braking force, which makes cars slow down or stops the moving car.

The Fig. 3-2-4 is a typical brake system showing all typical components. These are known as service brakes, base brakes, or foundation brakes. And Fig. 3-2-5 is a typical brake system components showing disc brakes on the front and drum brakes on

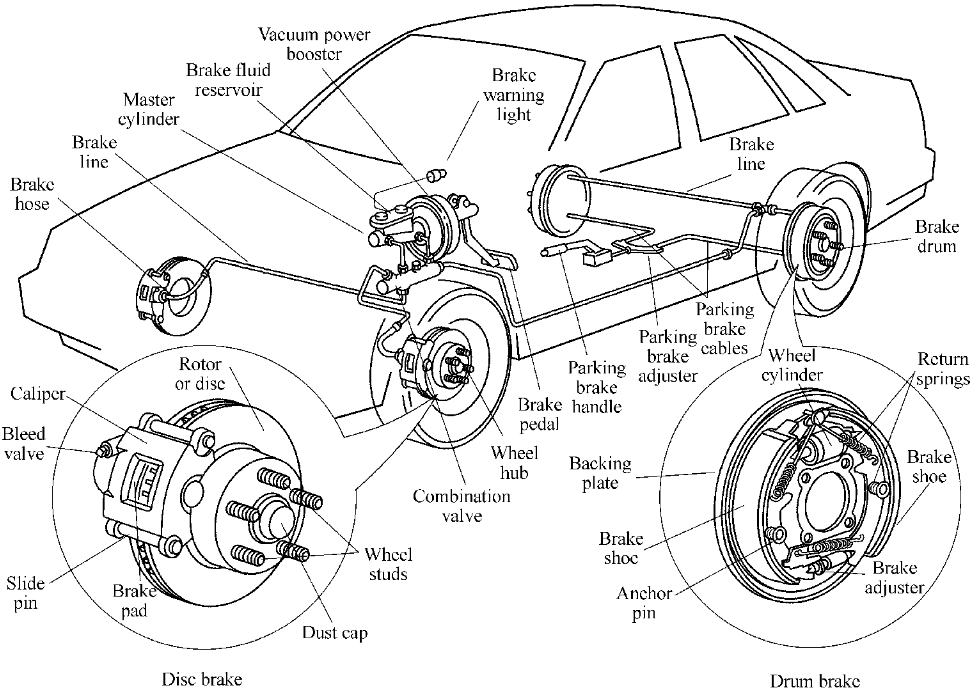


Fig. 3-2-4　Typical brake system

the rear.

1. Master Cylinder

In the modern brake system, the master cylinder is power-assisted by the engine. The master cylinder is located in the engine compartment on the firewall, directly in front of the driver's seat. A typical master cylinder has actually two completely separate master cylinders in one housing, each handling two wheels. That is to say, if one side fails, you will still be able to stop the car. The brake warning light on the dash will light if either side fails, alerting you to the problem. Master cylinders have become very reliable and rarely malfunction: however, the most common problem that they experience is an internal leak. This will cause the brake pedal to slowly sink to the floor when your foot applies steady pressure. Letting go of the pedal and immediately stepping on it again brings the pedal back to normal height.

Rear-wheel-drive vehicles use a dual-split master cylinder. Dual-split master cylinder use two separate pressure-building sections. One section operates the front brakes and the other section operates the rare brakes on vehicles equipped with a front or rare split system. See Fig. 3-2-5.

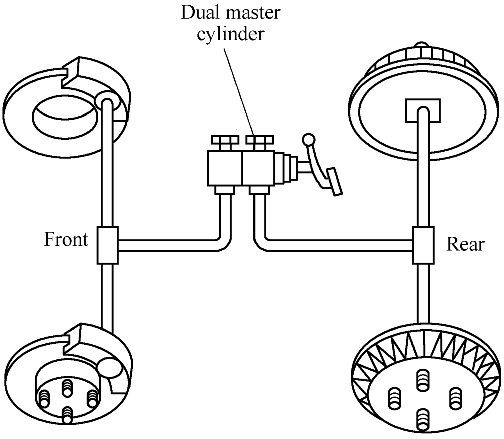


Fig. 3-2-5 Dual-split master cylinder

Front-wheel-drive vehicles use a diagonal split master cylinder. In this design, one section of the master cylinder operates the right front and the left rare brake and the other section operates the left front and right rare. In the even of a failure in one section, at least one front brake will still function. See Fig. 3-2-6.

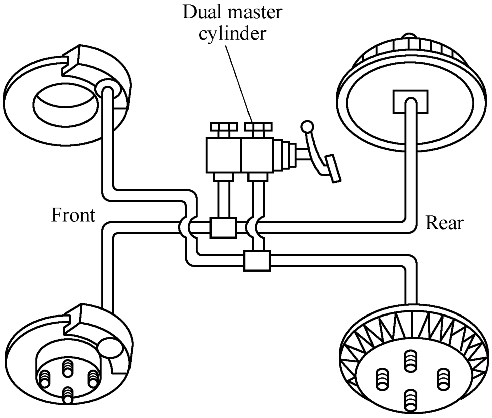


Fig. 3-2-6 A diagonal split master cylinder

2. Brake Lines and Hoses

The brake fluid travels from the master cylinder to the wheels through a series of steel tubes and reinforced rubber hoses. See Fig. 3-2-7. Rubber hoses are only used in places that require flexibility, such as at the front wheel, which move up and down as well as steer.

3. Brake Fluid

Brake fluid is special oil that has specific properties. It is designed to withstand cold temperatures without thickening as well as very high temperatures without boiling. If the brake fluid should boil, it will cause you to have a spongy pedal and the car will be hard to stop.

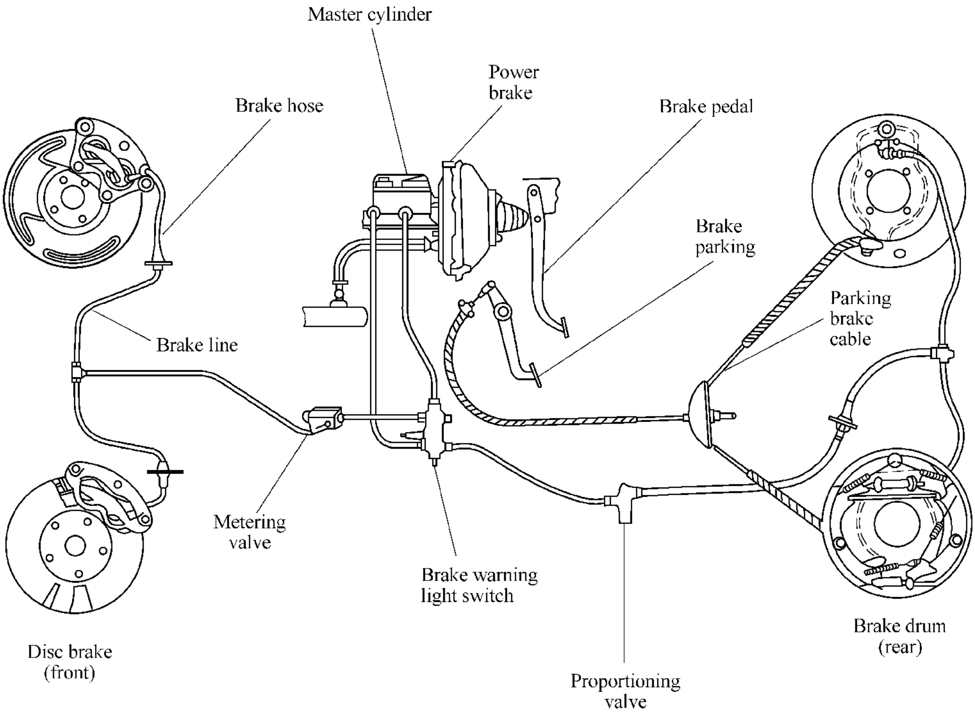


Fig. 3-2-7　Typical brake system components showing disc brakes on the front and drum brakes on the rear

New Words and Expressions

brake	n.	制动器, v. 制动
pedal	n.	踏板, v. 踩……的踏板
stationary	adj.	静止的, 固定的

unleveled	adj.	不平坦的，有坡度的
friction	n.	摩擦，摩擦力
pad	n.	摩擦衬块
drum	n.	制动鼓
disk	n.	圆板，圆盘，制动盘
shoe	n.	制动蹄片
resistance	n.	阻力
caliper	n.	卡钳
hydraulic	adj.	液力的，液压的
lining	n.	衬片，摩擦片
compartment	n.	室，舱
firewall	n.	防火墙
alert	v.	警报
dash	n.	仪表板
malfunction	n.	故障
reinforce	vt.	加强，补充

service brake	行车制动系
parking brake	驻车制动系
brake pedal	制动踏板
hand brake	驻车制动器
brake shoe	制动蹄片
disk brake	盘式制动器
drum brake	鼓式制动器
brake lining	制动衬片
brake fluid	制动液
disk rotor	盘形转子，制动盘
brake pad	制动块
wheel/brake cylinder	车轮(液压)制动分缸，轮缸
hydraulic pressure	液压
brake line	制动管路
brake hose	制动软管
engine compartment	发动机舱(室)
brake warning light	制动报警器
power brake booster	制动助力器

Exercises

Ⅰ. Answer the following questions according to the text.

1. What's the function of the brake?
2. How is the service brake operated ?
3. When is the parking brake used ?
4. What does the typical hydraulic brake system consist of ?

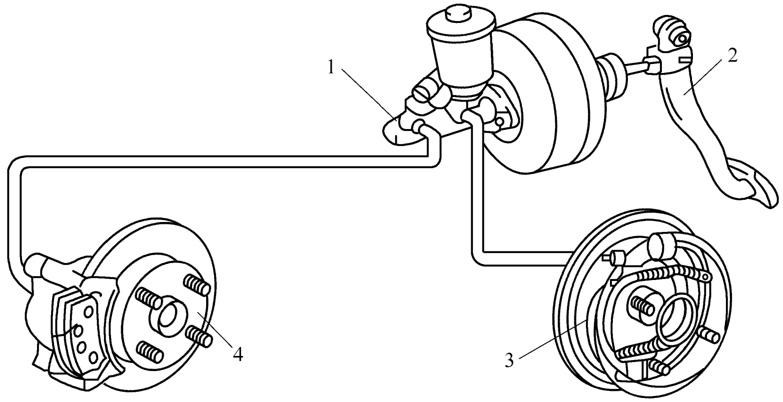
Ⅱ. Translate the following passage into Chinese.

The master cylinder is fluid-filled and contains two separate sections, there is a piston in each section and both pistons are connected to a pedal in the driver's compartment. When the brake is pushed down, brake fluid is sent from the master cylinder to the wheels. At the wheels, the fluid pushes shoes or pads against revolving drums or disks. The friction between the stationary shoes or pads and the revolving drums or disks slows or stops the revolving wheels, which, in turn, slow or stop the car.

Ⅲ. Read Abbreviations and then translate them into corresponding Chinese terms.

1.	BP	brake power	____________
2.	BPMV	brake power modulator valve	____________
3.	BC	brake cylinder	____________
4.	BHP	brake horsepower	____________
5.	BMEP	brake mean effective pressure	____________
6.	BMC	brake master cylinder	____________

Ⅳ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________

Unit 3 Steering System

During the traveling of the car, steering movement is the most basic movement. We manipulate and control the vehicle's rotating direction by using the steering wheel in order to realize our intentions. The function of the steering system is to achieve changes of the running directions and to keep a stable running route. See Fig. 3-3-1. Automobile steering system can be divided into manual steering system and power steering system by different energy of steering. Manual steering system relies on the driver's steering power to steer the wheel. Under the control of the driver, power steering system can steer the wheel through the use of liquid pressure produced by engine or motor driving force.

Electronic control power steering system(EPS) could make steering wheel convenient and flexible at low speed; steering in the region to high-speed, EPS also promises to provide optimal power magnification and stability to handle, thus enhancing the stability of the control during high-speed traveling. So it has been commonly used in car manufacturing in every country.

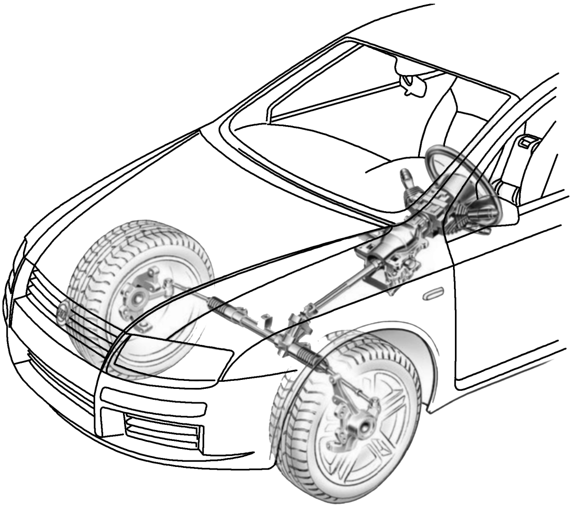


Fig. 3-3-1 Steering system

1. Manual Steering System

There are a couple of different types of steering gears. The most common ones are rack-and-pinion and recirculating-ball steering gears. Rack-and-pinion steering is quickly becoming the most common type of steering on compact car, small truck and

SUV in which the engine compartment space is limited. It is actually a pretty simple mechanism. The basic parts of a rack-and-pinion steering gear are shown in Fig. 3-3-2.

The rack-and-pinion gear-set does two things:

1) It converts the rotational motion of the steering wheel into the linear motion needed to turn the wheels.

2) It provides a gear reduction, making it easier to turn the wheels.

On most cars, it takes three to four complete revolutions of the steering wheel to make the wheels turn from lock to lock(from far left to far right).

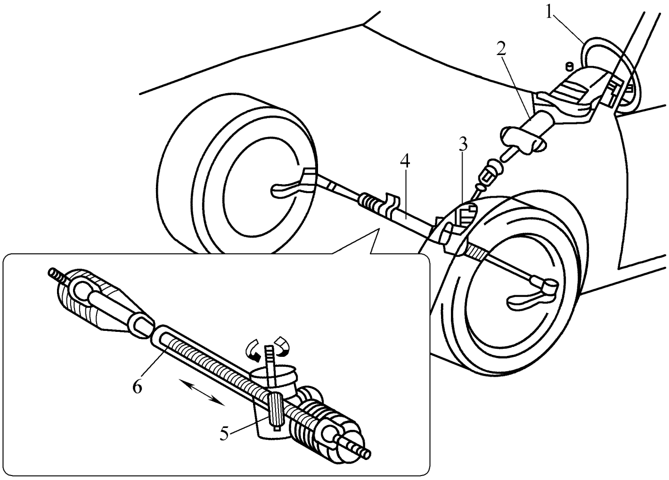


Fig. 3-3-2 Rack-and-pinion steering system

1—steering wheel 2—steering stem 3—steering gear

4—gear housing 5—gear 6—steering rack

Recirculating-ball steering is used on many trucks and SUVs today. The linkage that turns the wheels is slightly different than on a rack-and-pinion system. The larger and heavier the car, the more difficult it is to steer. Most large cars are equipped with a recirculating-ball steering gear. This type of steering gear is very low in friction and provides a good mechanical advantage for a heavy vehicle.

The recirculating-ball steering gear consists of several parts contained in a steering gear housing. The steering gear shaft is connected to the steering wheel either directly or through some type of flexible joint. The basic parts of a recirculating-ball steering gear are shown in Fig. 3-3-3.

2. Power Steering System

Power steering system is designed to reduce the effort required by the driver to turn the steering wheel. Actually, automobile power steering is “power assisted steering”.

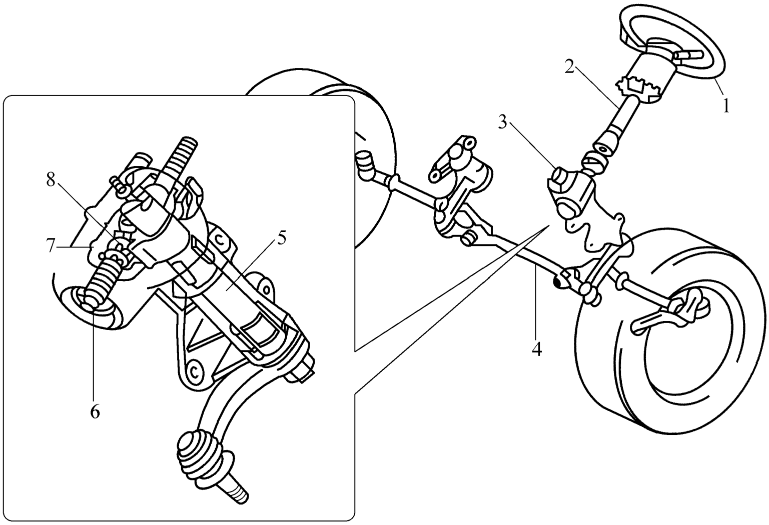


Fig. 3-3-3 Recirculating-ball steering system

1—steering wheel 2—steering stem 3—steering gear box 4—steering link
5—sector shaft 6—screw arbor 7—steel ball 8—ball nut

In a power steering system, power-assisted units use either hydraulic or air assist setups to make steering effort easier. Nowadays, electric power aided steering is also adopted on some small cars. Here, we just discuss the hydraulic type, which is widely used on various kinds of vehicles.

Power steering system adds a hydraulic pump, fluid reservoir, hoses, lines, and a power assist unit either mounted on, or integral with a steering wheel gear assembly. In addition, a control valve is incorporated somewhere in the hydraulic circuit. See Fig. 3-3-4.

The power steering pump, which is driven by a belt from the crankshaft pulley, sends fluid under pressure into the steering gear. This high-pressure fluid does about 80% of the work of steering. In operation, the pump produces a high pressure on the power-steering fluid, which is a kind of special oil.

Under normal conditions, only the minor part of the energy used for turning is supplied by the driver, while the major part is supplied by the engine via the steering gear. When the power steering gear fails to work, the driver has to supply all the turning power.

According to the source of the power and the way of control, the modern power steering system can be classified into the hydraulic power steering system, the electronic power steering system and the electric hydraulic power steering system. See Fig. 3-3-5, Fig. 3-3-6 and Fig. 3-3-7.

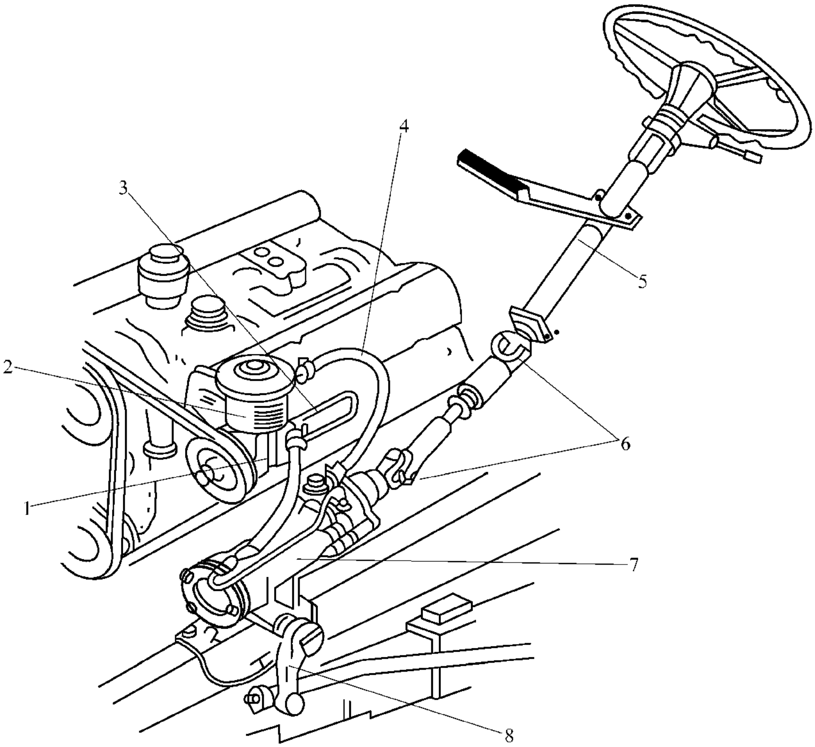


Fig. 3-3-4 Power steering system

1—power cylinder pump 2—pump reservoir 3—pressure hose 4—return hose
5—steering column 6—universal joints 7—steering gear 8—pitman arm

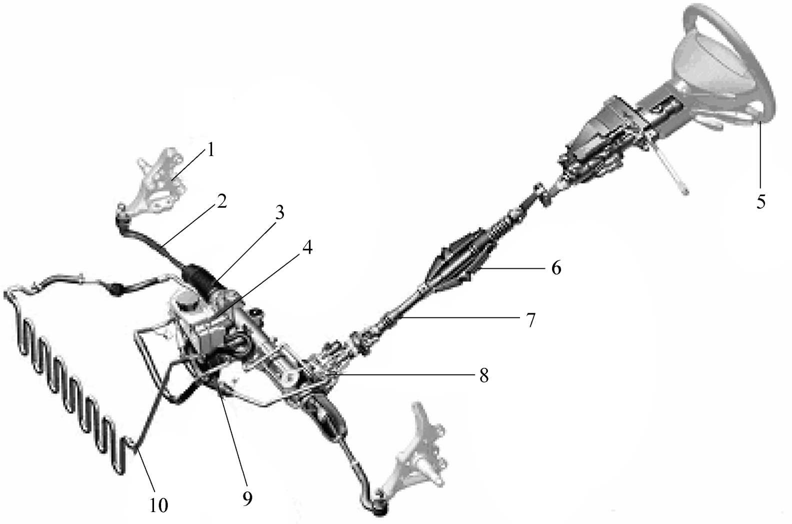


Fig. 3-3-5 Common hydraulic power steering system

1—steering knuckle 2—steering tie rod 3—steering tie rod boot seal 4—oil tank
5—steering wheel 6—steering stem boot seal 7—steering spindle
8—steering gearbox 9—vane pump 10—oil cooler

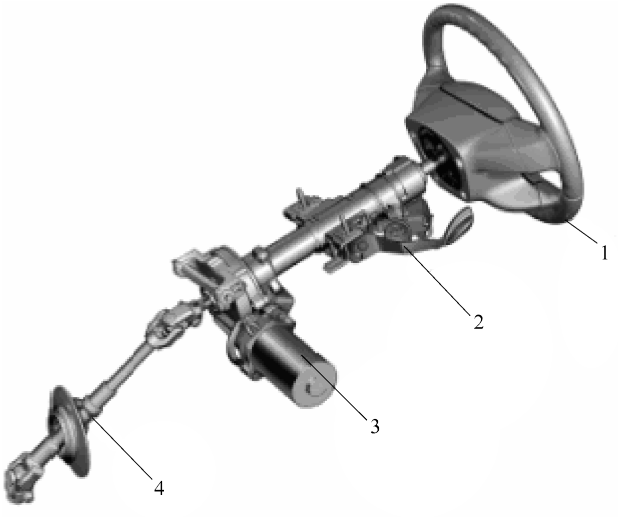


Fig. 3-3-6 Electronic power steering system

1—steering wheel 2—steering stem adjusting hand wheel

3—servo motor 4—steering spindle

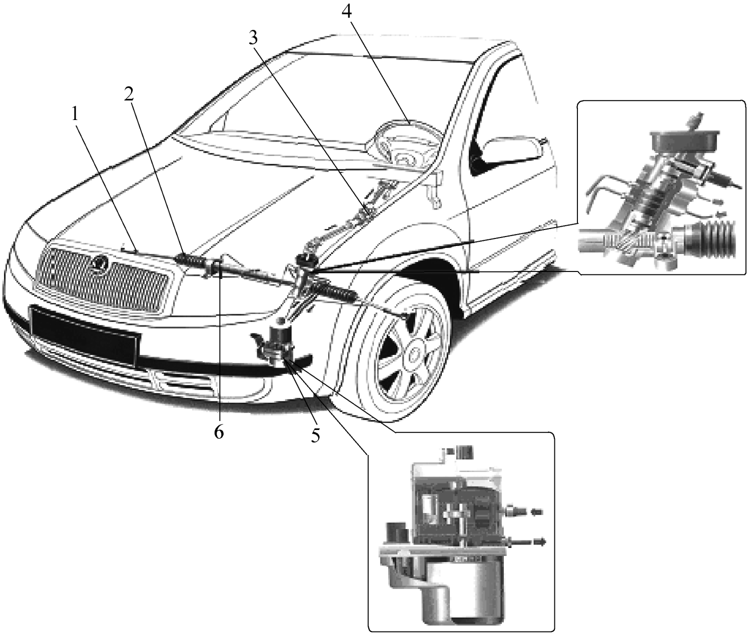


Fig. 3-3-7 Electric hydraulic power steering system

1—steering tie rod 2—steering tie rod boot seal 3—steering stem

4—steering wheel 5—pump electric motor 6—steering gear box

New Words and Expressions

manipulate	vt.	(熟练地)操作，使用(机器等)
handle	vt.	触摸，运用，买卖，处理，操作
hydraulic	adj.	液压的，水压的
magnification	n.	扩大，放大倍率
pinion	n.	小齿轮
integral	adj.	构成整体所需的，完整的
incorporate	v.	把……合并，列入，包含
pulley	n.	滑轮，带轮
linear	adj.	线的，直的
compact	adj.	紧凑的，紧密的
rack	n.	齿条

steering wheel	转向盘，方向盘
steering column	转向柱
steering shaft	转向轴
steering arm	转向摇臂
pulley-driven pump	从动轮缸
steering gear	转向器，转向装置，转向齿轮机构
rack-and-pinion steering gear	齿轮齿条转向器
air assist setups	空气助力机构
crankshaft pulley	曲轴带轮
rotary valve	转阀
pinion gear	小齿轮，主动齿轮
steering linkage	转向传动机构
lock to lock	(转向盘)总回转圈数
electronic control power steering system(EPS)	电子控制动力转向系统

Exercises

Ⅰ. Answer the following questions according to the text.

1. What’s the function of the steering system?
2. Please list the main components of the steering system.
3. When are the two widely used types of the steering gears ?

4. What are the advantages of the electronic control power steering system(EPS)?

5. According to the source of the power and the way of control, the modern power steering system can be classified into three types, what are they?

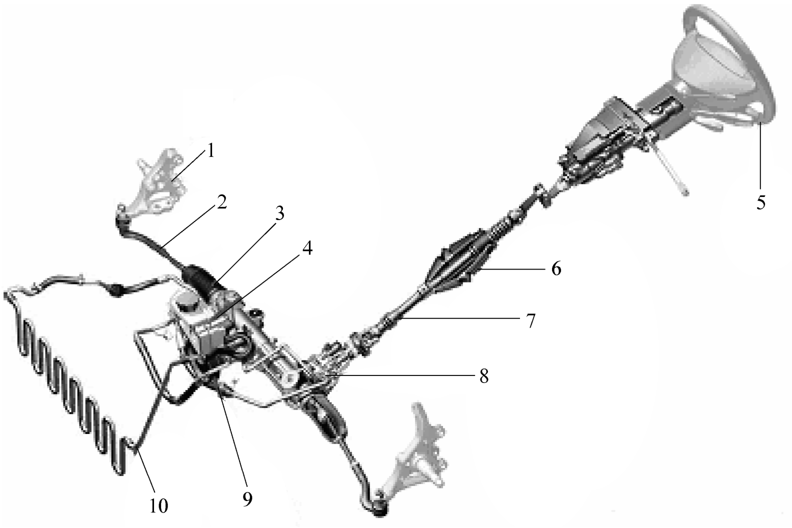
Ⅱ. Translate the following passage into Chinese.

The power steering pump, which is driven by a belt from the crankshaft pulley, sends fluid under pressure into the steering gear. This high-pressure fluid does about 80% of the work of steering. In operation, the pump produces a high pressure on the power-steering fluid, which is a kind of special oil.

Ⅲ. Read abbreviations and then translate them into corresponding Chinese terms.

1. VSC	vehicle stability control	________________
2. ABS	anti-lock brake system	________________
3. ABSCM	ABS control module	________________
4. PSCU	power steering control unit	________________
5. PS	power steering	________________
6. SUV	sport utility vehicle	________________

Ⅳ. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________ 4. ________ 5. ________

6. ________ 7. ________ 8. ________ 9. ________ 10. ________

Unit 4　Suspension System

The suspension is a device to make the vehicle body float with the aid of springs and other elastic components, which is made up of many elastic components. The suspension should improve the ride comfort and ensure the ride stability as well. The functions of a suspension system are as follows:

To prevent the road shocks from being transmitted to the vehicle frame.

To preserve the stability of the vehicle in pitching or rolling, while in motion.

To safeguard the occupants from road shocks.

To provide good road holding while driving, cornering and braking.

To maintain proper steering geometry.

1. Types of Suspension System

The suspension system supports the weight of the engine, transmission, car body, and whatever the car body is carrying. There are two basic suspension systems in use today. One is the solid axle, leaf spring type; the other is the independent suspension using long and short swinging arms. There are various adaptations of these systems, but all use the same basic principle.

The solid axle suspension uses a solid steel dead axle(does not turn with wheels) with a leaf spring at each side. The wheels swivel on each end via a pivot arrangement between the axle and the wheel spindle.

With an independent suspension, each front wheel is free to move up and down with a minimum effect on the other wheel. In an independent suspension system, there is also far less twisting motion imposed on the frame than in a system with a solid axle.

Almost all modern front suspension systems are independent. A few off-road, four wheel drive vehicles and large trucks continue to use a solid axle front suspension. Types of front suspension systems include the conventional front suspension, coil spring front suspension, torsion bar front suspension, Mac Pherson strut front suspension and solid axle front suspension. See Fig. 3-4-1.

The rear suspension may be of the solid axle or independent design. Many cars have solid axle rear suspension. Either design may have different kinds of springs. However, the coil spring and leaf spring types are most popular. See Fig. 3-4-2.

2. Automotive Springs and Shock Absorbers

Most suspension systems have the same basic parts-springs and shock absorbers and operate basically in the same way. They differ, however, in the type and arrangement

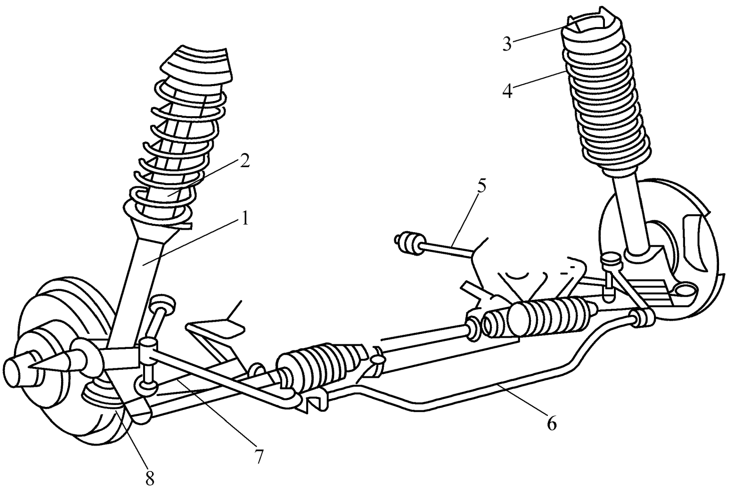


Fig. 3-4-1 Mac Pherson strut suspension

1—strut assembly 2—shock absorber 3—shock absorber fixed bold 4—coil spring
5—strut rod 6—sway bar 7—control arm 8—ball joint

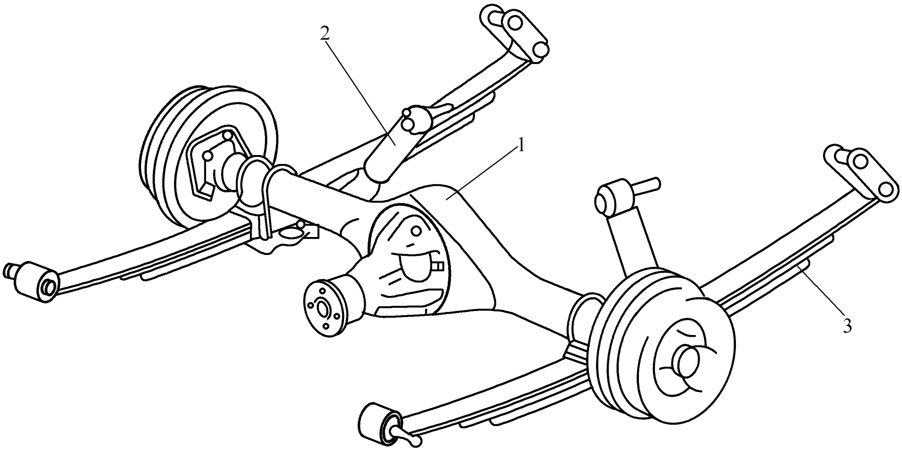


Fig. 3-4-2 Leaf type of non-independent suspension

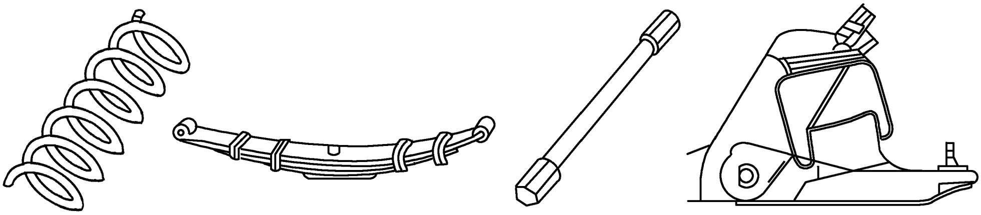
1—rear-axle case 2—shock absorber 3—leaf spring

of the linkages used to connect these parts to the frame and wheels.

(1) Springs

In a suspension system, the major component is springs. Springs are vital to vehicles because they support the weight of your car and allow it to remain stable even in rough driving conditions. They have the ability to expand when you hit dips on the road and compress when you encounter bumps or cut into hard corners.

The springs used on today's vehicles are engineered in a wide variety of types, shapes, sizes, rates, and capacities for each kind of automobile and truck depending on your vehicle's suspension design. There are four basic types of springs used in suspensions: leaf spring, coil springs, torsion bar spring and air spring. See Fig. 3-4-3 and Fig. 3-4-4.



Coil spring　Leaf spring　Torsion bar spring　Air spring

Fig. 3-4-3　Types of springs

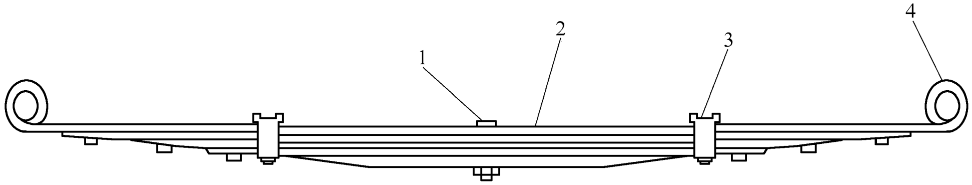


Fig. 3-4-4　A leaf spring assembly

1—center bolt　2—main leaf　3—rebound clip　4—spring eye

(2) Shock Absorbers

Springs alone will not give a satisfactory ride; shock absorbers must be used with them. On a car without shock absorbers, the repeated up-and-down movement of the springs and wheels would produce a very rough ride. Further, the driver would have great difficulty in controlling the car, particularly on curves.

To eliminate the excessive up-and-down movement of the springs and wheels, a shock absorber is placed at each wheel. Shock absorbers are filled with fluid. In operation, wheel movement causes the shock absorber to force this fluid through small openings (orifices). Since fluid can pass through restricted openings rather slowly, this puts a restraint on wheels and springs movement. The restraint imposed prevents excessive wheel movement. It also damps out the spring oscillations quickly after the hole or bump is passed. See Fig. 3-4-5 and See Fig. 3-4-6.

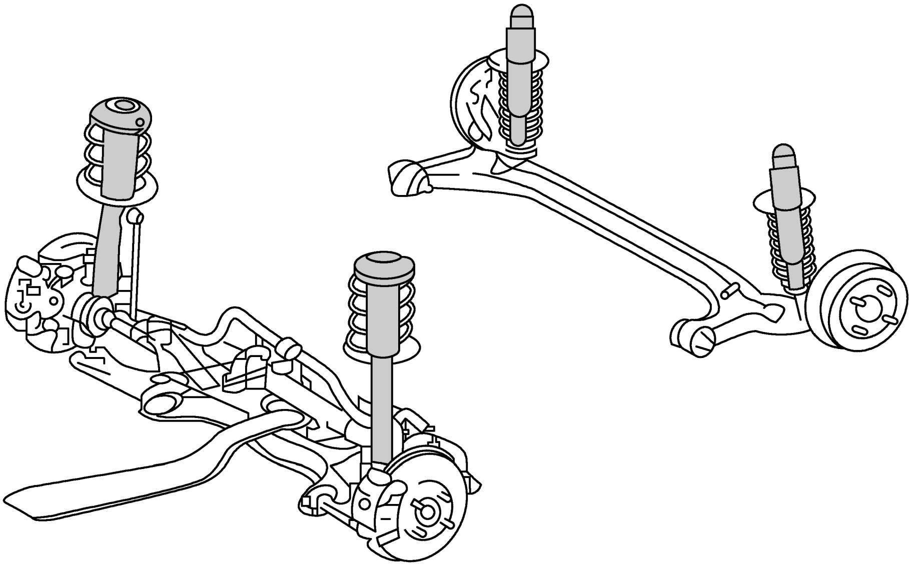


Fig. 3-4-5 Shock absorber

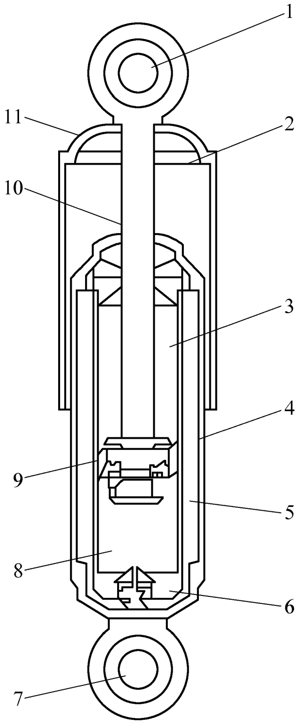


Fig. 3-4-6 The inside parts of a shock absorber

1—upper mounting 2—rod guide 3—rebound chamber 4—cylinder tube 5—reserve chamber 6—compression intake valve 7—lower mounting 8—compression chamber 9—piston and rebound valve 10—piston rod 11—fluid seal

New Words and Expressions

pitch	v.	前后颠簸，纵摇(区别于 roll 横梁)
adaptation	n.	改造(物)
suspension	n.	悬架
frame	n.	车架
swivel	v.	使旋转
twist	v.	扭转，扭曲
strut	n.	滑柱，支柱
beam	n.	梁，横梁
sway	n./v.	摇摆，摇动
lateral	adj.	侧面的，横向的
transverse	adj.	横向的
rebound	v./n.	回弹
stiffness	n.	刚度
traction	n.	牵引，牵引力
vertical	adj.	垂直的
oscillate	v.	震荡，摆动，振动
oscillation	n.	摆动，振动
uncontrollable	adj.	无法控制的，难以控制的
bounce	v.	(使)反跳，弹起，跳振，跳动
spindle	n.	轴
stabilizer	n.	稳定器

suspension system	悬架系
shock absorber	减振器
coil spring	螺旋弹簧
leaf spring	钢板弹簧
torsion bar spring	扭杆弹簧
air spring	空气弹簧
front suspension system	前悬架系
rear suspension system	后悬架系
traction bar	牵引杆
leaf pack	钢板弹簧组件
spring oscillation	弹簧的往复振动

front axle	前桥
rear axle	后桥
rigid axle	刚性整体车桥
lower control arm	下控制臂
sway bar	横向稳定杆
strut rod	支撑杆
stabilizer bar	横向稳定杆
double-wishbone suspension	双横臂式悬架，双 V 形式悬架
multi-link suspension	多连杆式悬架
torsion beam	扭矩梁
spring rate	弹簧刚度，弹簧刚度系数
live axle	活动轴，活轴
dead axle	不动车轴，不回转的车轴，定轴，静轴
non-independent(suspension) system	非独立悬架
independent(suspension)system	独立悬架
Mac Pherson strut	麦弗逊式滑柱
Mac Pherson strut front suspension	麦弗逊滑柱式前悬架
Electronic controlled suspension system	电控悬架系统

Exercises

Ⅰ. Answer the following questions according to the text.

1. What's the function of the suspension system?
2. There are two basic suspension systems in use today, what are they?
3. What are the key components that make up the suspension system?
4. Please list three types of springs in general use today.
5. What's the function of the shock absorber?

Ⅱ. Translate the following passage into Chinese.

The shock absorber is a hydraulic device. One end of the shock absorber is attached to a wheel assembly and the other end is attached to the vehicle frame. Shock absorber movement is limited by forcing fluid inside the shock absorber through passages or orifices. This causes the shock absorber to compress or extend at a slow rate.

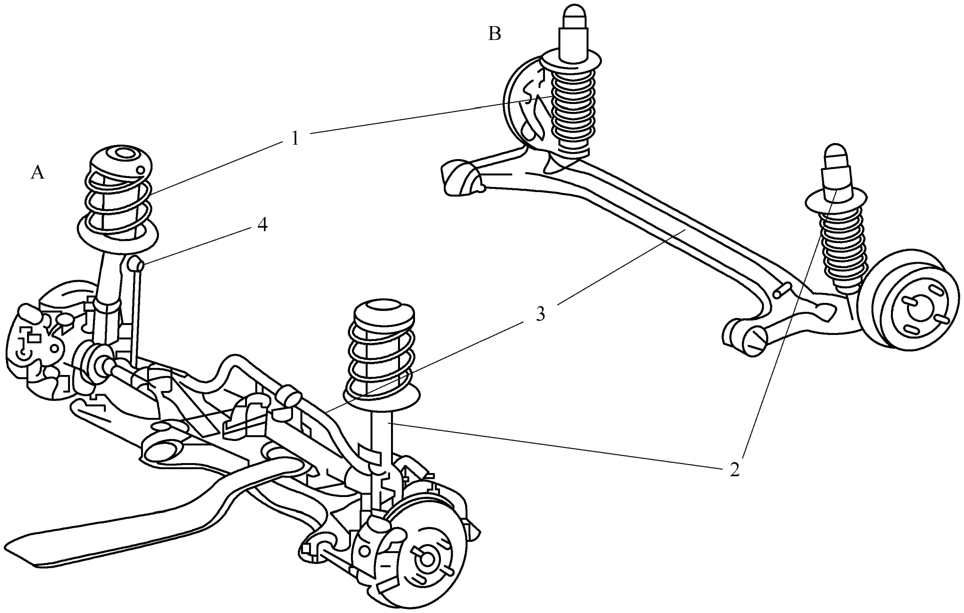
When the wheel goes over a bump, the shock absorber compresses. When the wheel goes into a hole, the shock absorber extends slowly. This action dampens spring

rate and controls spring oscillation.

Ⅲ. Read abbreviations and then translate them into corresponding Chinese terms.

1.	SUS	suspension	________________
2.	FH	frame height	________________
3.	FA	front axle	________________
4.	RA	rear axle	________________
5.	LS	leaf spring	________________
6.	TB	torsion bar	________________

Ⅳ. Write out the terms according to the picture.



A. ________ B. ________

1. ________ 2. ________ 3. ________ 4. ________

Chapter Four Body and Electrical System

Unit 1 Body

The body severs the obvious purpose of holding the driver, passengers and goods, providing shelter, comfort and protection for the occupants.

The body provides three-quarters of the vehicle's total rigidity in bending and in torsion. In the case of collision, it is intended to resist and minimize intrusions into the occupant space. In addition, it provides a cushioning effect through the use of padded interiors, a compliant windshield, and an energy absorbing steering column and dash, all of which help ameliorate the impact of an unrestrained occupant against the interior of the passenger compartment. The body, therefore, is a relatively rigid structure with a compliant interior. Limited exterior structural compliance, however, is desirable to reduce the acceleration of collision experienced by the body.

The body panels are stamped from sheet metal at fabrication plants and transmitted to the assembly plant in special containers or racks. Structurally, it is made of large, thin panels with typical gage thickness of 0.76 to 1.02mm. See Fig. 4-1-1.

The body is generally divided into four sections: the front, the rear, the top and the underbody. These sections can be further divided into a lot of assemblies and parts, such as the hood, the fenders, the roof panels, the door, the instrument panel, the bumpers and the luggage compartment. The body assembly map as shown in Fig. 4-1-2.

For assembly, the parts are placed in jigs which travel along the assembly line and which maintain alignment while welding takes place. The assemblies of the whole body is combined by spot welding and bolting.

When the main body structure has sufficient stiffness to stand along, the jigs are removed and the remaining structure parts are attached. Finally, doors, windows, truck lids, trim item and so on are added to complete the assembly. The designers have begun to pay attention to the body construction and hope to get it more luxurious and more comfortable.

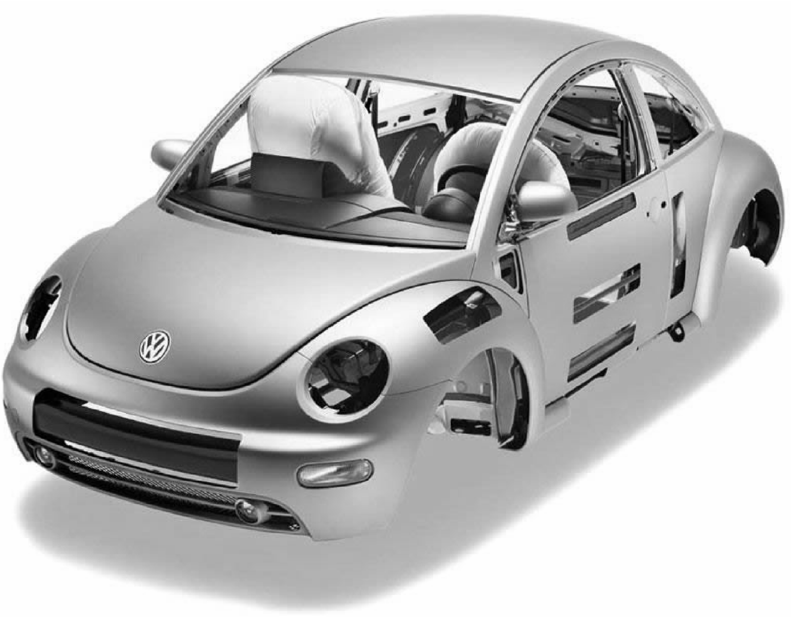


Fig. 4-1-1 Body

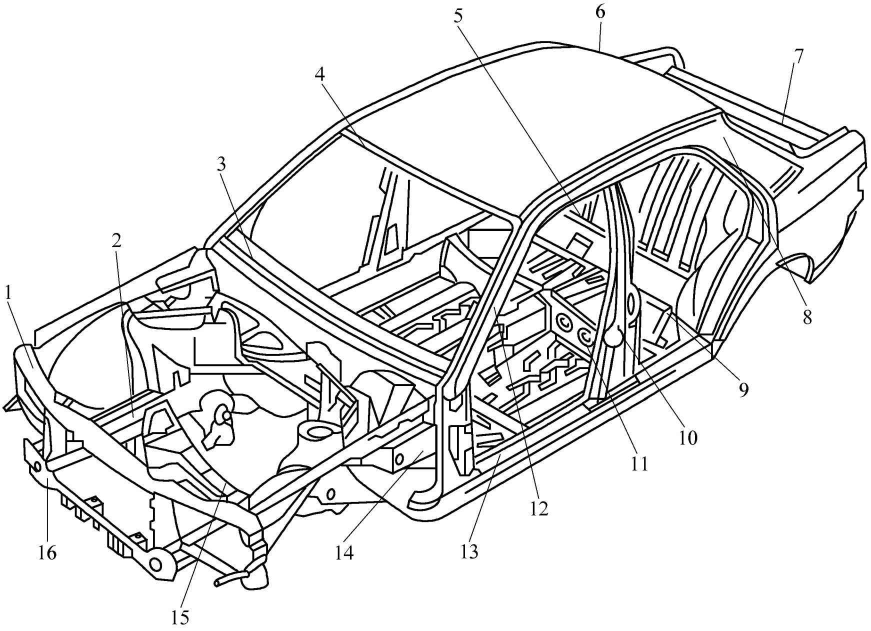


Fig. 4-1-2 Body assembly map

1—front end panel 2—front side member 3—cross member under windshield 4—front roof bow

5—roof rail 6—rear roof bow 7—rear end panel 8—rear pillar 9—side member

10—center pillar 11—cross member under seat 12—center pillar 13—side member

14—wheel well 15—engine-support cross member 16—front cross member

New Words and Expressions

obvious	adj.	明显的
shelter	n.	保护，庇护
protection	n.	保护
occupant	n.	乘员
intrusion	n.	打扰，侵入
cushion	v.	对(某事物)起缓冲作用
compliant	adj.	柔顺的，顺从的，百依百顺的
compliance	n.	柔顺性，配合性
ameliorate	v.	改进，改善
unrestrained	adj.	无节制的，放肆的
stamp	v.	冲压
structurally	adj.	结构上的
gage	n.	计量，标准
thickness	n.	厚度
underbody	n.	底板
hood	n.	发动机罩
fender	n.	挡泥板
roof	n.	车身顶板
bumper	n.	汽车保险杠
luggage	n.	行李
jig	n.	夹具
stiffness	n.	坚硬
lid	n.	盖，罩
trim	n.	装饰，(汽车内部)装潢
item	n.	条款
luxurious	adj.	豪华的
comfortable	adj.	舒服的

three-quarters	四分之三
padded interiors	内部加垫装修
occupant space	承载空间
energy absorbing steering column	能量吸收式转向柱

Exercises

Ⅰ. Answer the following questions according to the text.

1. What's the function of the body?
2. The body is generally divided into four sections, what are they ?

Ⅱ. Translate the following passage into Chinese.

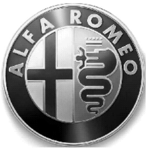
The body is generally divided into four sections: the front, the rear, the top and the underbody. These sections can be further divided into a lot of assemblies and parts, such as the hood, the fenders, the roof panels, the door, the instrument panel, the bumpers and the luggage compartment.

Ⅲ. Translate the following phrases into Chinese or English.

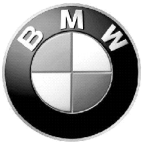
1. front end panel ________________
2. engine-support cross member ________________
3. cross member under windshield ________________
4. front cross member ________________
5. 能量吸收式转向柱 ________________
6. 后座下横梁 ________________
7. 前柱 ________________
8. 前纵梁 ________________

Ⅳ. The followings are some expressions for the famous brands. Match the following brands in Column A with their Chinese equivalents in Column B.

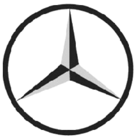
Column A



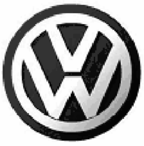
1.__________



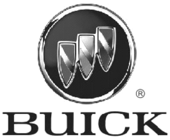
2.__________



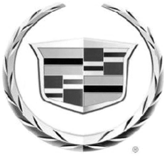
3.__________



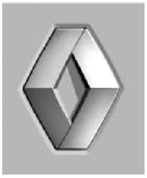
4.__________



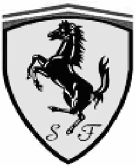
5.__________



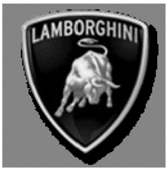
6.__________



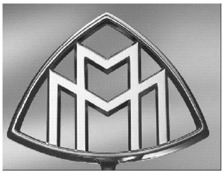
7.__________



8.__________



9.__________



10.__________

Column B

A. Mercedes-Benz 梅赛德斯-奔驰
B. Alfa-Romeo 阿尔法·罗密欧
C. Volkswagen AG 大众
D. Renault 雷诺
E. Maybach 迈巴赫
F. Buick 别克
G. BMW 宝马
H. Cadillac 凯迪拉克
I. Lamborghini 兰博基尼
J. Ferrari 法拉利

Unit 2 Instrument Panel

Vehicle information displaying system is one of the important systems of the automobile. The driver can know whether the cars, especially the various operating parameters of the engine are normal or not in order to take timely measures to prevent the occurrence of physical and mechanical accidents.

Traditional instruments widely use the combination analog displaying instruments, and various measuring instruments are fixed on the dashboard in front of the driver's seat. The instrumentations in different vehicle instrument panels are not the same. As is shown in Fig. 4-2-1, it is a typical combination car instrument panel.

The instruments commonly used include speedometer, engine tachometer, oil pressure gauge, water temperature gauge, fuel gauge, ammeter, etc. Changes of the monitored object's status are directly shown in most instruments through the sensors.

With the development of automotive electronic technology, multifunctional, high-precision instrument with intuitive readings, which is shown by electronic digital and image, has been used in vehicles continuously.

1. Indicators

(1) Low Oil Pressure Indicator(Shown in Fig. 4-2-2)

It is an engine oil pressure warning light. The light should come on every time when ignition key is turned to ON or START, and should go off when the engine starts. If the light stays on or comes on while the engine is running, you have lost oil pressure and continued operation will cause severe engine damage. Stop and check.

(2) Charging System Indicator(Shown in Fig. 4-2-3)

This light comes on every time when you turn your ignition key to ON or START. The light should go off when the engine starts and the alternator begins to charge. If the light stays on or comes on when the engine is running, have the charging system checked as soon as possible.

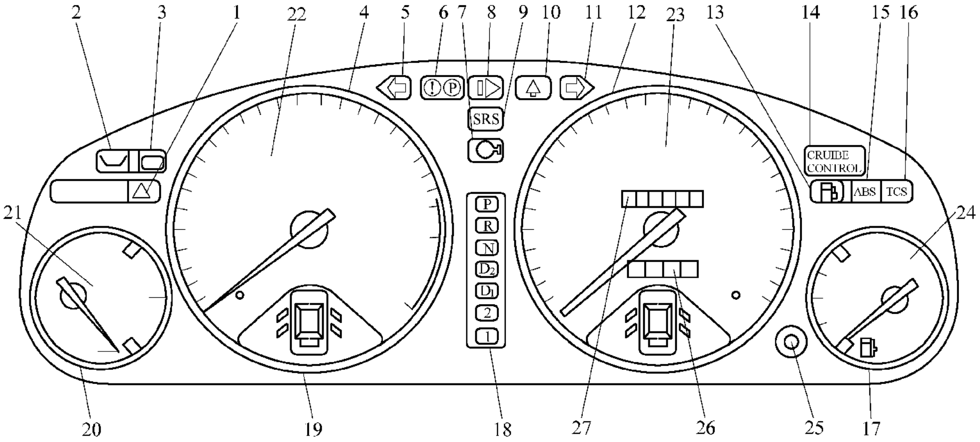


Fig. 4-2-1　A typical combination car instrument panel

1—hazard warning indicator　2—low oil pressure indicator　3—charging system indicator　4—tachometer　5—left turn signal light　6—parking brake and brake system indicator　7—check engine indicator　8—high beam indicator　9—SRS indicator　10—seat belt indicator　11—right turn signal light　12—speedmeter and odometer　13—low fuel indicator　14—cruise control indicator　15—ABS indicator　16—TCS indicator　17—fuel gauge　18—shift lever position indicator　19—door monitor　20—temperature gauge　21—temperature gauge　22—tachometer　23—speedometer　24—fuel gauge　25—trip meter reset button　26—odometer　27—trip meter

(3) Parking Brake and Brake System Indicator(Shown in Fig. 4-2-4)

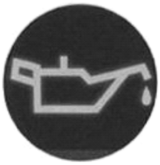


Fig. 4-2-2

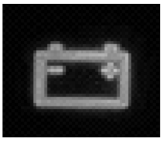


Fig. 4-2-3

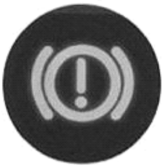


Fig. 4-2-4

This light has two functions:

① It lights as a reminder that you have set the parking brake. On some types, the light goes on briefly when the ignition switch is turned to START with the parking brake released. Driving with the parking brake set can damage the brakes and tires, and cause the ABS to turn off.

② It can indicate the brake fluid level is low if it remains light after you release the parking brake or comes on while driving. This is normally due to worn brake pads.

Have your dealer check the braking system for worn pads or fluid leaks.

(4) Seat Belt Indicator and Buzzer(Shown in Fig. 4-2-5)

This indicator lights when you turn the ignition switch to ON. It is a reminder to you and your passengers to protect yourselves by fastening the seat belts. A beeper also sounds if you have not fastened your seat belt and it will stop after a few seconds. But the light stays on until you do. Both the light and the beeper stay off if you fasten your seat belt before turning on the ignition.

(5) Check Engine Indicator(Shown in Fig. 4-2-6)

This light comes on when the engine electronic control system is not working properly. Take vehicle to the dealer immediately.

(6) Anti-lock Brake System(ABS)Indicator(Shown in Fig. 4-2-7)

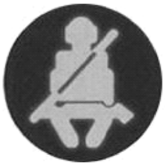


Fig. 4-2-5

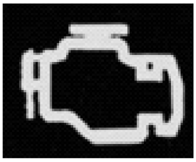


Fig. 4-2-6

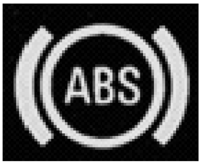


Fig. 4-2-7

This light normally comes on when you turn the ignition switch to ON and goes off after the engine starts. If it comes on at other time, there is a problem in the ABS. If this happens, take the car to your dealer to have it checked. With the light on, your car still has normal braking ability but no anti-lock.

(7) Door and Brake Lamp Monitor(Shown in Fig. 4-2-8)

The appropriate light comes on in this display if the boot or any door is not closed tightly. If a brake light does not work, the brake lamp indicator comes on when you push down the brake pedal with the ignition switch ON. A burned out brake light is a hazard when drivers behind you can not be told that you are braking. Have your brake light repaired right away. All the lights in the monitor display come on for a few seconds when you turn the ignition switch to ON.

(8) Low Washer Fluid Light(Shown in Fig. 4-2-9)

This light illuminates when there is less than a quarter of the container of washer fluid left. Add washer fluid.

(9) Low Fuel Indicator(Shown in Fig. 4-2-10)

This light comes on when your fuel gauge indicates approximately 1/8 fuel of tank. Fill up the tank with fuel.

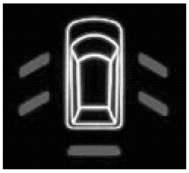


Fig. 4-2-8

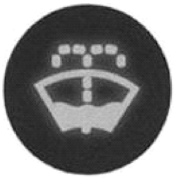


Fig. 4-2-9

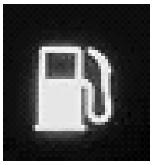


Fig. 4-2-10

(10) Cruise Control Indicator (Shown in Fig. 4-2-11)

This light comes on when you set the cruise control. When you tap the brake or clutch pedal, or press the SET and RESUME buttons at the same time, the cruise control light on the instrument panel will go out and the car will begin to slow down. You can use the accelerator pedal in the normal way.

(11) Traction Control System (TCS) Indicator (Shown in Fig. 4-2-12)

The TCS light normally comes on when you turn the ignition switch to ON and goes off after the engine starts. If it doesn't, or it stays on after possible engine starts, there is a problem with the TCS. Check it as soon as possible.

(12) Supplemental Restrain System (SRS) Indicator (Shown in Fig. 4-2-13)

The airbag warning light goes on to alert the driver of trouble in the SRS system when a malfunction is detected in the center airbag sensor assembly self-diagnosis. In-normal operating conditions when the ignition switch is turned to the ON position, the light goes on for about 6 seconds and then goes off.

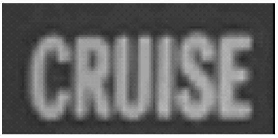


Fig. 4-2-11

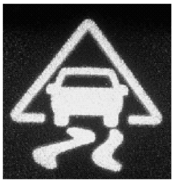


Fig. 4-2-12

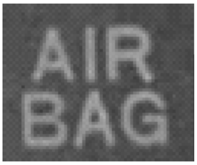


Fig. 4-2-13

(13) Brake Friction Plate Indicator (Shown in Fig. 4-2-14)

The light is used to show the condition of the brake friction plate. It comes on when the brake friction plate had problems or wore too much. It turns off after changing the brake.

(14) Brake pedal Indicator (Shown in Fig. 4-2-15)

The light is used on the vehicles that are equipped with automatic transmission. It prompts you can shift P gear or N gear to the other gears when you step on braking pedal down.

(15) Electronic Stable Procedure Control System Indicator (ESP Indicator) (Shown in Fig. 4-2-16)

The light is used to show the working condition of the electronic stable procedure control system and its problems. The light comes on for a few seconds when ignition key is turned to ON, and the vehicle carry on self-checking. And the light turns off after a few seconds. The light stays on if the engine electronic control system had problems. The light stays flashing if the system is working when you are driving.

(16) Engine coolant Temperature Indicator(Shown in Fig. 4-2-17)

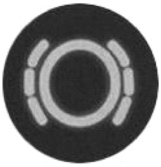


Fig. 4-2-14

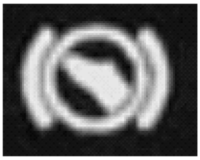


Fig. 4-2-15

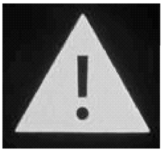


Fig. 4-2-16

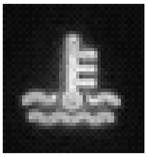


Fig. 4-2-17

The light should comes on for a few seconds when ignition key is turned to ON, and then it will go off. If the light stays on or flashing, it shows that the temperature of the fluid is too high or the coolant level is too low. So you should turn off the engine to check the coolant level. Follow the instructions in the Maintenance Book and add coolant if necessary.

2. Gauges

(1) Temperature Gauge

It shows the temperature of the coolant of the engine. During normal operation, the pointer should rise from C(Cold) to the NORMAL band. When you are driving in heavy traffic or uphill in hot weather, the pointer may reach the top of the NORMAL band. If it reaches the H(Hot) band, the engine is over heating and may cause engine damage. Stop and check.

(2) Fuel Gauge

It shows how much fuel you have in the fuel tank. For fuel gauge proper operation, the ignition switch must be in the OFF position before you add fuel to the fuel tank. It is accurate when the car is on level ground. It may vary slightly while the vehicle is in motion.

(3) Speedometer

It shows your speed in kilometers per hour(km/h). On some types, when the speed is over approximately 120km /h, a buzzer sounds.

(4) Tachometer

It shows the engine speed in revolution per minute(r/min). To protect the engine from damage, never drive with the tachometer needle in the red zone.

(5) Odometer

This meter shows the total number of kilometers your car has been driven. The trip odometer shows the number of kilometers or miles driven since you last reset it. To reset it, press reset button to return the trip odometer to zero.

New Words and Expressions

various	adj.	不同的，各种各样的，多方面的
parameter	n.	参数，参量
occurrence	n.	发生
speedometer	n.	速度表
tachometer	n.	转速表
ammeter	n.	电流表
intuitive	adj.	直觉的
continuously	adv.	不断地，连续地
instrument	n.	器具，仪器
panel	n.	仪表板，仪表盘
hazard	n.	危险
warning	n.	警告
indicator	n.	指示器，指示表
pressure	n.	压力
charging	n.	充电
signal	n.	信号
check	v.	检查，检测(汽车后部的)行李箱
odometer	n.	里程表
cruise	v./n.	(汽车)以快而平稳的车速长距离行驶，常称为“巡航”
gauge	n.	仪表，计量计
monitor	n.	监视器
severe	adj.	严重的；剧烈的
damage	n./v.	损坏
alternator	n.	发电机
reminder	n.	提醒物；提示

worn	adj.	损坏的，破旧的
dealer	n.	销售商；特约维修店
buzzer	n.	蜂鸣器
fasten	v.	系牢，扣住
beeper	n.	喇叭
electronic	adj.	电子的
appropriate	adj.	恰当的
boot	n.	(汽车后部的)行李箱
illuminate	v.	照明，照亮
tap	v.	(用脚)踩，踏
resume	v./n.	重新开始
traction	n.	牵引，拖，拉
supplemental	adj.	辅助的
restrain	v.	约束，制止
airbag	n.	气囊
alert	v.	警示
malfunction	n.	故障
self-diagnosis	n.	自我诊断

combination car instrument panel	汽车组合仪表板
oil pressure gauge	机油压力表
water temperature gauge	水温表(冷却液温度表)
fuel gauge	燃油表
hazard warning indicator	危险警告灯
charging system	充电系统
left turn signal light	左转向信号灯
parking brake and brake system	驻车制动及踏板制动系统
high beam	远光灯
seat belt	座椅安全带
cruise control indication	巡航控制指示灯
shift level	变速杆
washer fluid	洗涤液
brake lamp monitor	制动灯监视器
burn out	熄灭
traction control system(TCS)	牵引力控制系统

supplemental restrain system(SRS)	辅助约束保护系统
heavy traffic	交通繁忙

Exercises

Ⅰ. Translate the following passage into Chinese.

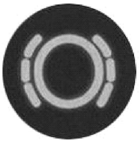
The instruments commonly used include speedometer, engine tachometer, oil pressure gauge, water temperature gauge, fuel gauge, ammeter, etc. Changes of the monitored object's status are directly shown in most instruments through the sensors.

With the development of automotive electronic technology, multifunctional, high-precision instrument with intuitive readings, which is shown by electronic digital and image, has been used in vehicles continuously.

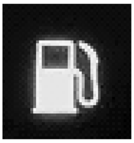
Ⅱ. Translate the following phrases into Chinese or English.

1. low oil pressure indicator ________________
2. parking brake and brake system indicator ________________
3. check engine indicator ________________
4. door and brake lamp monitor ________________
5. combination car instrument panel ________________
6. left turn signal light ________________
7. supplemental restrain system(SRS) ________________
8. traction control system(TCS) ________________

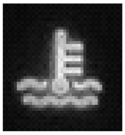
Ⅲ. Write out the terms according to the picture.



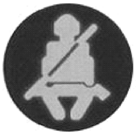
1. ______



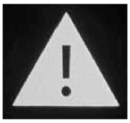
2. ______



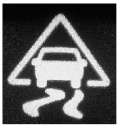
3. ______



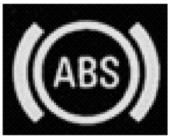
4. ______



5. ______



6. ________



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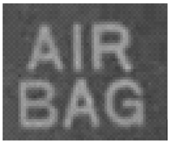
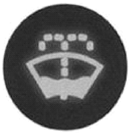
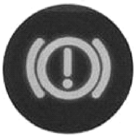


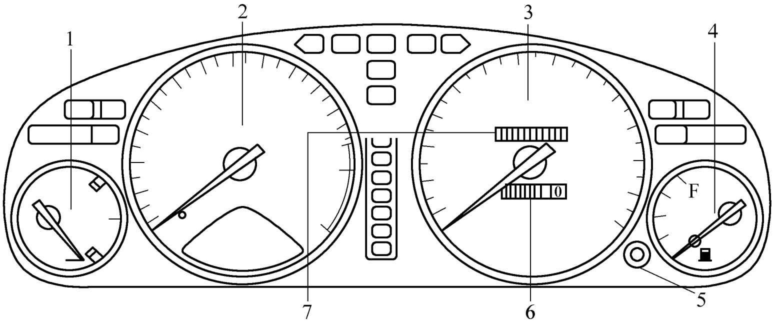
8. __________



9. ________



10. ________



1. ____________ 2. ____________ 3. ____________ 4. ____________
5. ____________ 6. ____________ 7. ____________

Unit 3 Air Conditioning System

When the weather gets hot outside, there is nothing more important than making sure it stays cool and comfortable inside your car. Automobile air conditioning is a system that cools and dehumidifies air entering the passenger compartment. Automobile air conditioning ushered a revolution in the automobile sector, redefining the benchmark of luxury cars. Introduced in the 1940s, automobile air conditioning has gained so much popularity.

Air conditioning system has such functions as follows:

1) Keep us cool in hot day.
2) Get us warm in cold day.
3) Make the air of the car's interior clean and dehumidify.
4) Let outside air enter the car at the desired speed.

Vehicles have primarily three different types of air conditioning systems. While each of the three types differs, the concept and design are very similar to each other. The most common components which make up these automotive systems are the following: compressor, condenser, evaporator, expansion valve, receiver-drier, etc. See Fig. 4-3-1. Fig. 4-3-2 shows the cooling process of the air condition.

Referred to as the "heart" of the air conditioners, compressor compresses and then transfers the refrigerant gas. It has two sides, which serve the function of suction and pump. The suction takes in gas from the evaporator, while the pump sends it to the condenser. Condenser is here the gas is dissipated. Hot gas is cooled in the condenser. Designed like a car radiator, a condenser does not perform a function obverse

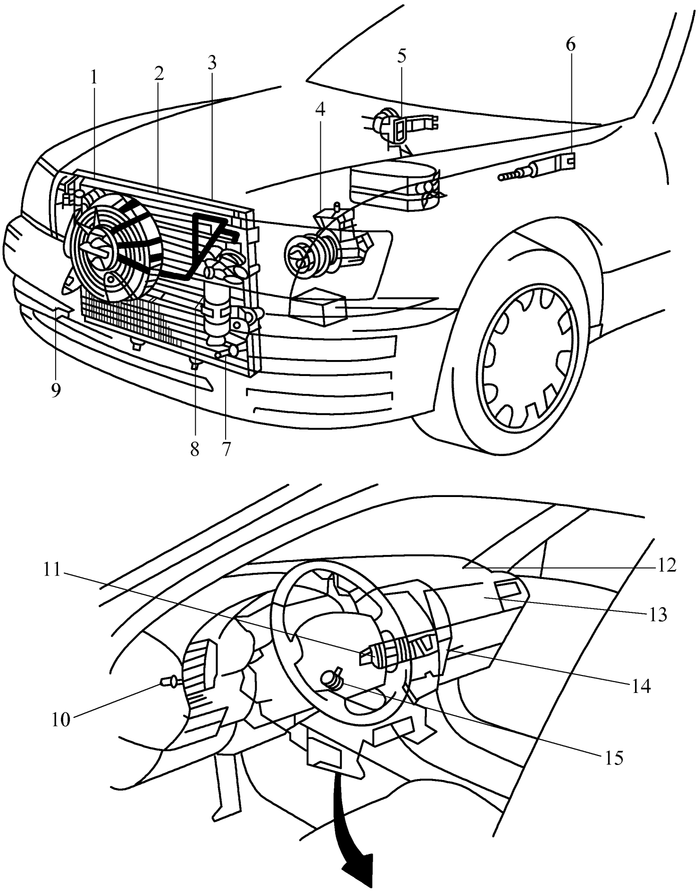


Fig. 4-3-1 Air conditioning system

1—electric fan 2—condenser 3—pressure switch 4—compressor 5—water valve
6—evaporator pressure regulator 7—engine coolant temperature switch 8—receiver
9—ambient temperature sensor 10—air passage sensor 11—air conditioning amplifier
12—solar sensor 13—air passage sensor 14—air conditioner control assembly
15—room temperature sensor

to the former. Evaporator functions as the site where heat is absorbed from the vehicle. The optimum temperature for the evaporator is 0℃. These are mostly different types of pressure regulating devices, mostly tubes that help to regulate the flow of refrigerant air into and out of the compressor.

In recent years, R-134a(CH_2F-CF_3) is widely used as refrigerant instead of R-12 in air conditioning system. It has more advantages than R-12. It does not deplete the ozone layer which helps to protect us from the ultraviolet from the sun, and its evaporative temperature is much higher than that of R-12.

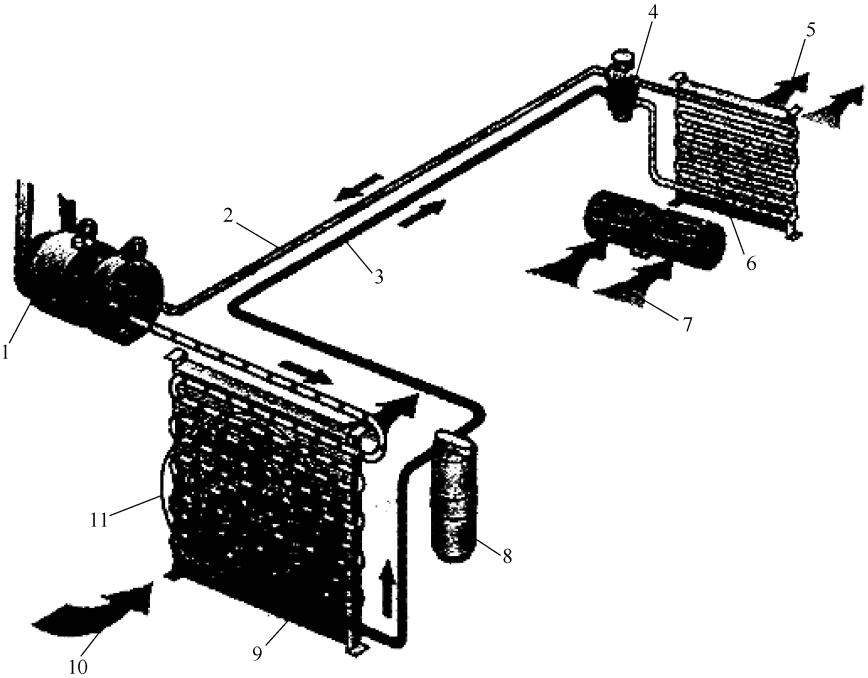


Fig. 4-3-2 The cooling process of the air condition

1—compressor 2—low-pressure side 3—high-pressure side 4—expansion valve 5—cooled fresh air 6—evaporator 7—warm fresh air 8—receiver 9—condenser 10—cooling air 11—electric fan

New Words and Expressions

dehumidify	v.	除湿，使干燥
interior	adj.	车身内部的，室内的，里面的；
dehumidify	v.	除湿
desired	adj.	期望的，预期的
differ	adj.	不一致，不同
evaporator	n.	蒸发箱
benchmark	n.	基准
accumulator	n.	储能器
Freon	n.	氟
dryer	n.	干燥器
compressor	n.	压缩机
orifice	n.	孔，口
dissipate	v.	散去，驱除

refrigerant	adj.	制冷的	n. 制冷剂
condense	v.	冷凝，压缩	
condenser	n.	冷凝器	
suction	n.	吸入	
evaporate	v.	蒸发	
radiator	n.	散热器	

air conditioning(A/C)	空气调节装置
expansion valve	膨胀阀，溢流阀，蒸发阀
orifice tube	节流孔管
air flow volume	气流量
air passage sensor	风道传感器
air conditioning amplifier	空调放大器

Exercises

Ⅰ. Answer the following questions according to the text.

1. What's the function of the air conditioning system?
2. Please name the major parts that make up the fuel system.
3. What's the function of the compressor?
4. Please tell the cooling process of the air condition.

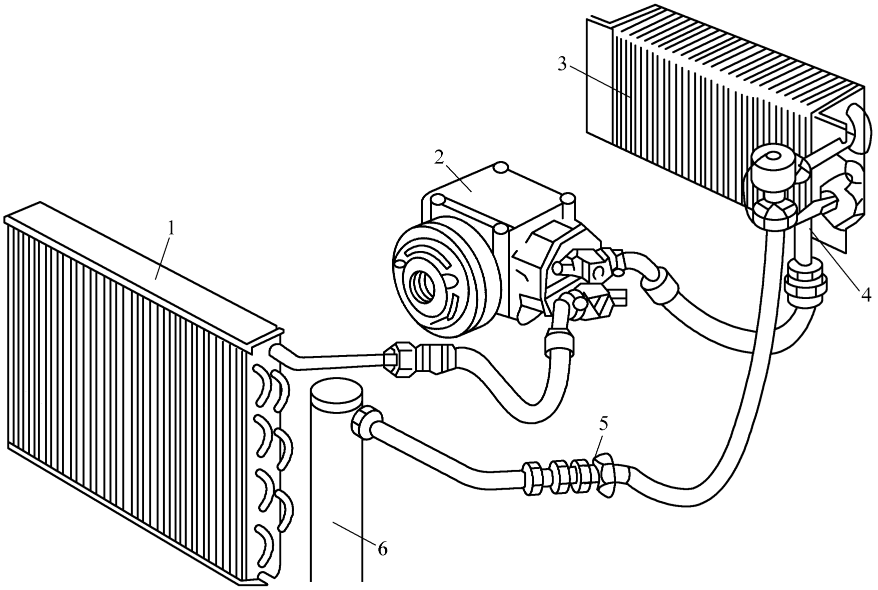
Ⅱ. Translate the following passage into Chinese.

Vehicles have primarily three different types of air conditioning systems. While each of the three types differs, the concept and design are very similar to one another. The most common components which make up these automotive systems are the following: compressor, condenser, evaporator, expansion valve, and receiver-drier, etc.

Ⅲ. Translate the following phrases into Chinese or English.

1. evaporator pressure regulator ____________________
2. air conditioner control assembly ____________________
3. air conditioning amplifier ____________________
4. ambient temperature sensor ____________________
5. high-pressure side ____________________
6. expansion valve ____________________
7. air passage sensor ____________________
8. air conditioning(A/C) ____________________

Ⅳ. The following is automotive air-conditioning refrigeration system. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________
4. ________ 5. ________ 6. ________

Unit 4 Anti-Lock Brake System

The function of an anti-lock, or anti-skid, braking system is to prevent the wheels from locking under hard braking. Maximum braking force is obtained just before the wheels lock and skid. Such anti-skid systems are useful on slippery surfaces, such as ice and snow, where the wheels may lock easily. Locked wheels are dangerous because the car needs a much longer distance to stop. Locked wheels also can cause the driver to lose control.

The ABS consists of components such as the wheel-speed sensors, stoplight suitch hydraulic unit in hydraulic brake booster(HBB), ECU, and pressure regulator, shown in Fig. 4-4-1.

The system uses a sensor that knows when one wheel(or a pair of wheels) is skidding. The sensor sends a signal to a computer, which signals a modulator valve. The modulator connects into the hydraulic system and can momentarily release the brake pressure and prevent the wheels from locking. The pressure release is so fast that a

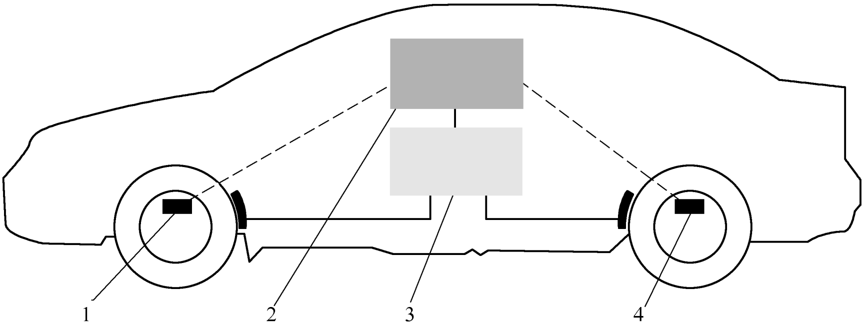


Fig. 4-4-1 The components of ABS

1—wheel-speed sensor(front wheel) 2—ECU 3—pressure regulator

4—wheel-speed sensor(rear wheel)

driver is seldom aware of it. Pressure is then reapplied until the sensor again senses that the wheel is about to lock up. Thus, this system keeps the wheels as close to lock up as possible, without actually allowing the wheels to lock up and skid. This is called incipient lock up. Maximum braking occurs at that point. See Fig. 4-4-2.

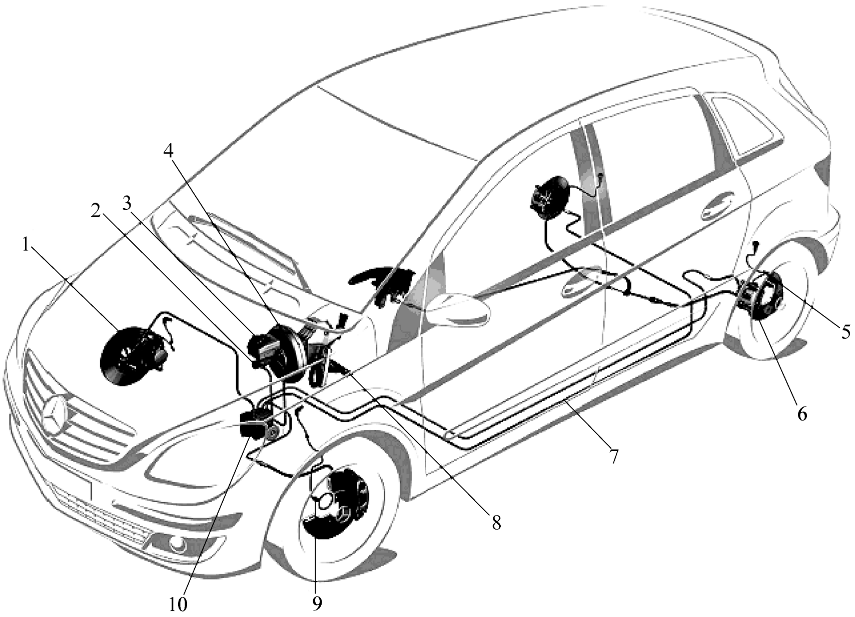


Fig. 4-4-2 The arrangement map of the ABS

1—front brake 2—brake master cylinder 3—brake reservoir 4—brake booster

5—rear-wheel sensor 6—rear brake 7—brake pipe 8—brake pedal

9—front-wheel speed sensor 10—pressure regulator and ECU

Fig. 4-4-3 is anti-lock brake system of Bendix-6

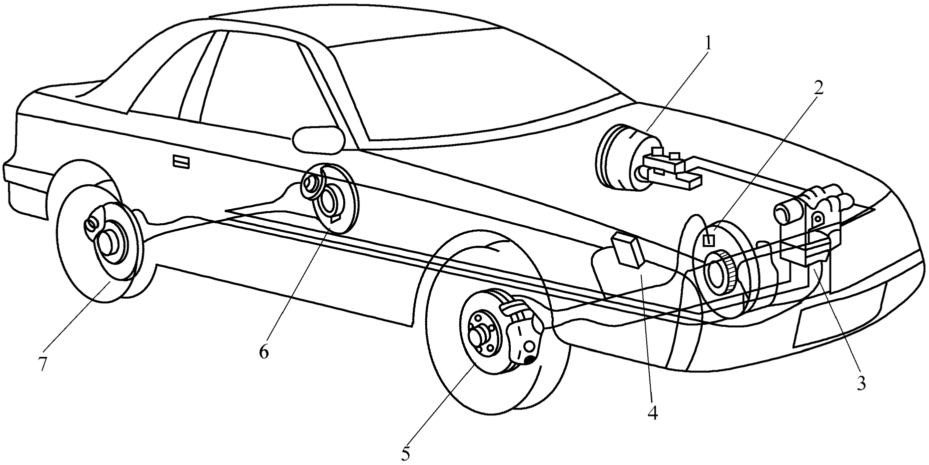


Fig. 4-4-3　Anti-lock brake system of Bendix-6

1—vacuum booster and master cylinder　2—wheel speed sensor

3—modulation assembly　4—electronic control unit　5—front disc brake

6—wheel speed sensor　7—rear disc brake

New Words and Expressions

booster	n.	助力器
modulator	n.	调节器
momentarily	adv.	即刻地
incipient	adj.	初始的
skid	v.	滑动，打滑(空转)，(侧向)滑移

antilock brake system	防抱死制动系统
wheel-speed sensor	轮速传感器
hydraulic pressure	液压，水压，油压
impending brake	紧急制动

Exercises

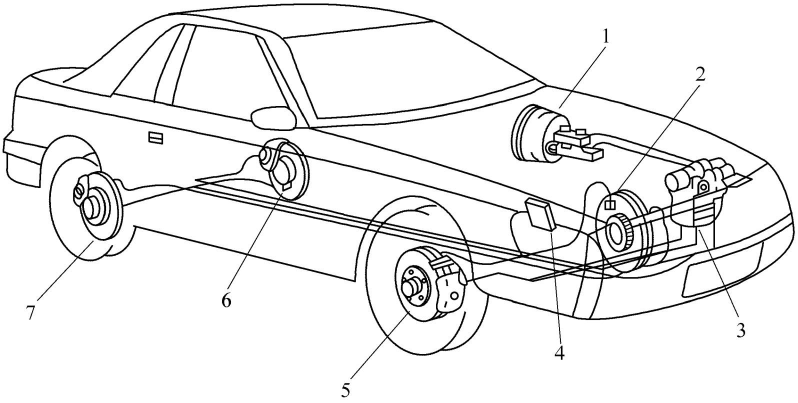
Ⅰ. Answer the following questions according to the text.

1. What's the function of an anti-lock brake system?
2. Please name the major parts that make up an anti-lock brake system.

Ⅱ. Translate the following abbreviations into corresponding Chinese terms.

1. ABS anti-lock brake system ________________
2. AP accelerator pedal ________________
3. BMC brake master cylinder ________________
4. PKB parking brake ________________
5. BTR brake transmission ratio ________________
6. NPS neutral position switch ________________

Ⅲ. The following is anti-lock brake system of Bendix-6. Write out the terms according to the picture.



1. ____________ 2. ____________ 3. ____________ 4. ____________
5. ____________ 6. ____________ 7. ____________

Unit 5 Air Bag System

Safety is foremost in the automobile manufacturers' minds. In order to guarantee optimal protection of vehicle occupants, lots of newer vehicles utilize air bag system. An air bag is much like a nylon balloon that quickly inflates to stop the forward movement of the occupant's upper body.

Air bags have saved thousands of lives since their introduction in the early 1980s. Most of cars had only a driver side air bag and a passenger side air bag ten years ago. Today, some cars go far beyond having dual air bags to having six or even eight air bags. The occupants in the front seat may be further protected by side air bags and side curtain air bags. The rear passengers may be protected by air bags in the rear of the front seat backs, side air bags and side curtain air bags.

An air bag system consists of impact sensors, an air bag inflation device and an air bag. The system can detect an impact, and send a signal that inflates the air bag.

The sensor is the device that detects an impact and tells the bag to inflate. The number of sensors used in a system depends on the design of the system. Some systems use only a single sensor and others use up to five. Normally sensors are located in the engine and passenger compartments. To prevent accidental deployment of the air bag, most systems require that at least two sensor switches be closed to deploy the air bag. Typical, ignition of the air bag only occurs when an outside sensor and an inside sensor are closed.

The inflation of the air bag is typically accomplished through an explosive release of nitrogen gas. An air bag inflation device includes igniter, nitrogen gas, filters and sodium azide. The igniter is an integral part of the inflator assembly. It starts a chemical reaction to inflate the air bag. At the center of the igniter assembly is the squib. When voltage is supplied through the squib, an electrical arc is formed between two pins. The spark ignites a solid propellant, which bums extremely rapidly to create a large volume of gas to inflate the bag.

The bag itself is made of a thin, nylon fabric that is folded into the steering wheel, dash, seat, or door. The powdery substance released from the air bag when it is deployed is regular cornstarch or talcum powder. These powders are used by the air bag manufacturers to keep air bags lubricated and pliable while they are in storage.

The following four steps show how the SRS air bag works:

1) In an impact, sensors in the car detect the sudden deceleration. If the crash is severe enough, electricity flows to the inflator and causes ignition of the gas generator.

2) The gas generator then rapidly burns in the metal chamber. The rapid burning produces inert gases and small amounts of dust. The inert gases and dust are cooled and filtered during inflation of the air bag.

3) The inflating air bag splits open the trim cover. The air bag then rapidly unfolds and inflates in front of the occupant.

4) After inflation, the gas is vented through openings or open weave areas in the air bag. These steps take place in a fraction of a second. Air bags deflate in under a second and may be pushed aside for occupants to exit. See Fig. 4-5-1.

In the future, we will further expand the number of vehicles equipped with 6 air bags by adding side air bags that protect the arm and chest areas and curtain air bags that protect the head area in side impacts. See Fig. 4-5-2.

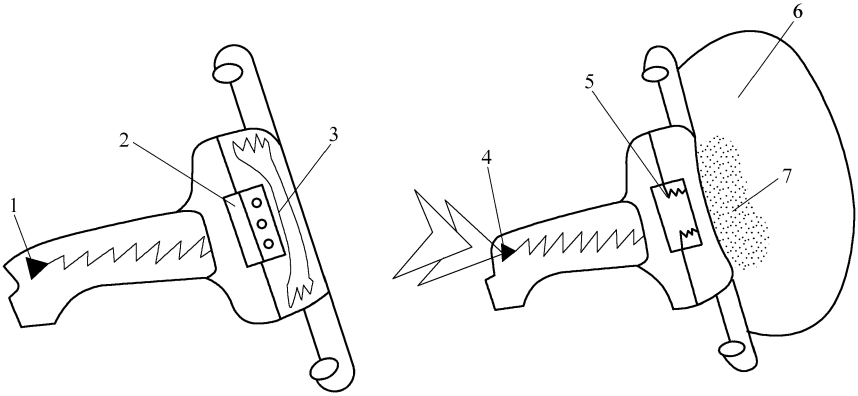


Fig. 4-5-1 How air bag works

1，4—crash sensor 2，5—inflator 3，6—air bag 7—nitrogen gas

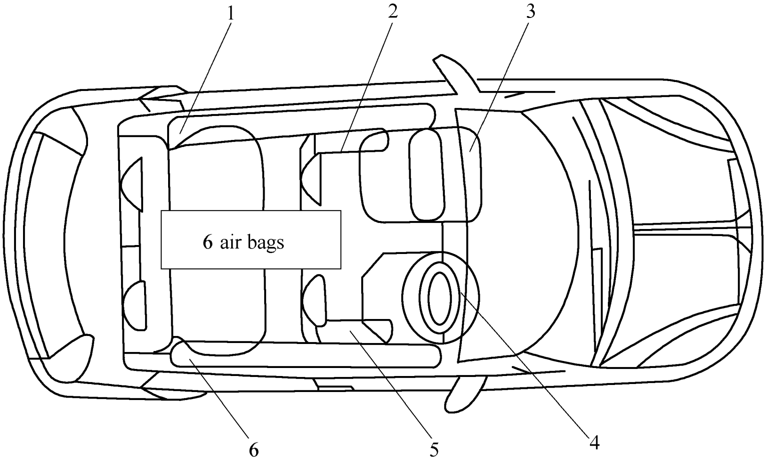


Fig. 4-5-2 Six-air bag system

1，6—curtain air bag system 2，5—side air bag system 3—passenger air bag system 4—driver air bag system

New Words and Expressions

nylon	n.	尼龙
inflate	v.	膨胀，充气
inflator	n.	充气机，打气筒
occupant	n.	占据者
nitrogen	n.	氮
sodium	n.	钠
azide	n.	叠氮化物
squib	n.	雷管

arc	n.	弧，弧形，弧度	
propellant	n.	推进物	
dash	n.	控制板	
fabric	n.	织品，布	
cornstarch	n.	玉米淀粉	
talcum	n.	滑石	
crash	n.	碰撞	
impact	n.	碰撞，冲击，冲突	
deceleration	n.	减速，减速度	
inert	adj.	惰性的	
split	v.	劈开，(使)裂开	
unfold	vt.	打开，展开	
vent	n.	放气孔	v. 放出，排出

air bag system	安全气囊系统
nylon balloon	尼龙气球
impact sensor	撞击传感器
inflation device	充气装置
air bag	气囊
passenger compartment	驾驶室
nitrogen gas	氮气
sodium azide	叠氮化纳
chemical reaction	化学反应
electrical arc	电弧
steering wheel	转向盘
nylon fabric	尼龙布
talcum powder	滑石粉
air bag inflator	安全气囊气体发生器
gas generator	气体发生器
push aside	把……推开，避开
side air bag	侧气囊

Exercises

Ⅰ. Answer the following questions according to the text.

1. What's the function of the air bag system?

2. What components does an air bag inflation device include?

Ⅱ. Translate the following passage into Chinese.

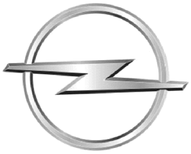
The sensor is the device that detects an impact and tells the bag to inflate. The number of sensors used in a system depends on the design of the system. Some systems use only a single sensor and others use up to five. Normally sensors are located in the engine and passenger compartments. To prevent accidental deployment of the air bag, most systems require that at least two sensor switches be closed to deploy the air bag. Typical, ignition of the air bag only occurs when an outside sensor and an inside sensor are closed.

Ⅲ. Translate the following phrases into Chinese or English.

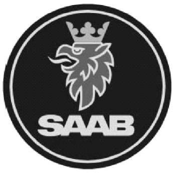
1. air bag system ____________________
2. air bag module ____________________
3. radiator support ____________________
4. solid chemical gas ____________________
5. center air bag sensor assembly ____________________
6. 气囊传感器 ____________________
7. 安全气囊气体发生器 ____________________
8. 气体发生器 ____________________

Ⅳ. The followings are some expressions for the famous brands. Match the following brands in Column A with their Chinese equivalents in Column B.

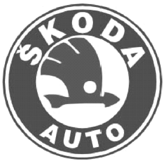
Column A



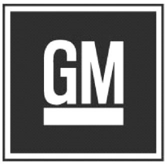
1. ________



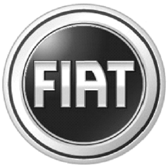
2. ________



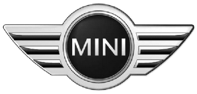
3. ________



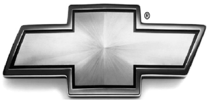
4. ________



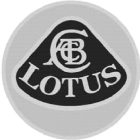
5. ________



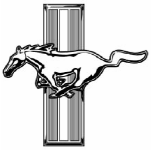
6. ________



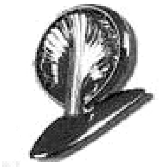
7. ________



8. ________



9. ________



10. ________

Column B

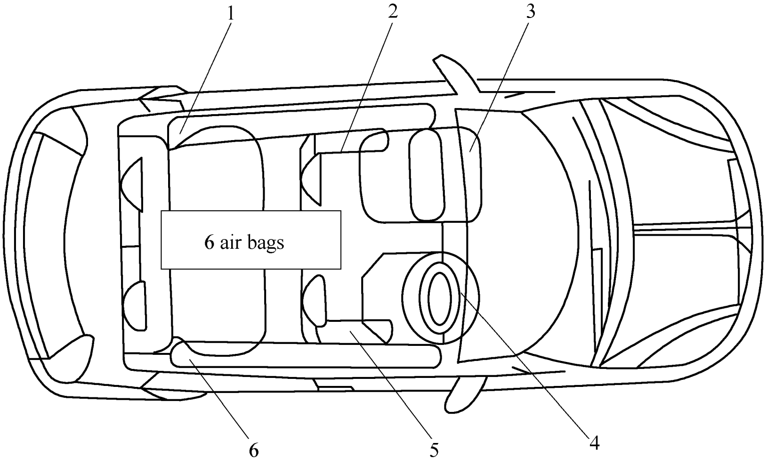
A. Skoda 斯柯达

B. GM 通用

C. Mustang 野马

D. Fiat 菲亚特	E. Chevrolet 雪佛兰	F. Lotus 莲花
G. President 日产总统	H. Mini 迷你	I. Saab 萨博
J. Opel 欧宝		

Ⅴ. The following is anti-lock brake system of Bendi X6. Write out the terms according to the picture.



1. ________ 2. ________ 3. ________

4. ________ 5. ________ 6. ________

Unit 6 Global Positioning System

The global positioning system(GPS) is a satellite-based positioning system planned by the U. S. Department of Defense in the early 1970's and has been operational since 1995.

The system enables the positioning of objects near the surface of the earth at any time. GPS can display specific traffic and travel information on a display screen. It can mark the location of the vehicle, plot out the best way of getting to a destination, and tell the driver how many miles have been traveled and how many remain before reaching a destination. It can also display traffic information regarding traffic backups due to congestion, and accidents, then display alternative routes so travel is not delayed. In addition, it has the anti-theft function. The accuracy of a typical GPS is about 10 ~ 15 meters. This is not practical for locating the automobiles because they are usually only about three meters' long. But with the development of the technology, the differential GPS(DGPS) system has been able to improve the accuracy of the GPS to

about one to two meters.

The GPS consists of three segments: the space segment, the control segment, and the user segment.

The space segment includes the 24 satellites that broadcast navigation signals to receivers through carder waves. The 24 satellites are distributed in six circular orbits with an inclination angle of 55° in groups of 4 satellites each. Each satellite is located 26565.5km away from the earth's centre, orbiting the globe every 12 hours. The arrangement guarantees that 6 to 11 satellites are always in view at any point on the globe's surface provided that they are not blocked due to physical interruptions.

The control segment traces and monitors the satellites through ground control stations to monitor their locations and check on their status. The need for the control segment is that satellites can go out of planned position and they need to be adjusted for the designed ideal spacing in the GPS satellite network.

The user segment refers to the user-end GPS receiver that calculates the time it takes to send and receive radio signals from satellites in its view. By calculating the travel-time of signal from and to the satellites, a GPS receiver can find out the distance between the current position of the receiver and the satellites. There are at least three satellites so that the GPS receiver can calculate a 2D position and the track movement.

New Words and Expressions

global	adj.	全球的
satellite	n.	人造卫星
destination	n.	目的地
differential	adj.	微分的，差分的
navigation	n.	导航
orbit	v.	沿着轨道运行
global positioning system(GPS)		全球定位系统
positioning system		定位系统
display screen		显示屏
carrier wave		载波
radio signal		无线电信号

Exercises

Ⅰ. Answer the following questions according to the text.

1. The global positioning system(GPS) is a satellite-based positioning system. When

did it plan by the U. S. Department of Defense and when has it been operational?

2. What can the global positioning system(GPS)do?

3. How many satellites that the GPS receiver can calculate a 2D position and the track movement?

Ⅱ. Translate the following passage into Chinese.

Global positioning system(GPS)enables the positioning of objects near the surface of the earth at any time. GPS can display specific traffic and travel information on a display screen. It can mark the location of the vehicle, plot out the best way of getting to a destination, and tell the driver how many miles have been traveled and how many remain before reaching a destination. It can also display traffic information regarding traffic backups due to congestion, and accidents, then display alternative routes so travel is not delayed. In addition, it has the anti-theft function.

Ⅲ. Translate the following phrases into Chinese or English.

1. global positioning system(GPS) ______________
2. radio signal ______________
3. display screen ______________
4. carrier wave ______________
5. anti-theft alarm ______________

Ⅳ. Translate the following names of cars into Chinese.

1. Daewoo ______________
2. Ssangyong ______________
3. Hyundai ______________
4. Kia ______________
5. Skoda ______________
6. Dacia ______________
7. Protom ______________
8. Smart ______________
9. Ferrari ______________
10. Piaggio ______________

Unit 7 Cruise Control System

Cruise control(sometimes known as speed control)system is a system that automatically controls the rate of motion of a motor vehicle. The driver sets the speed and the system will take over the throttle of the car to maintain the same speed. The parts of cruise control system and their location are shown in Fig. 4-7-1.

Modern cruise control system was invented in 1945 by the blind inventor and mechanical engineer Ralph Teetor. His idea was born out of the frustration of riding in a car driven by his lawyer, who kept speeding up and slowing down as he talked. The first car with Teetor's system was the Chrysler Imperial in 1958. This system calculated ground speed

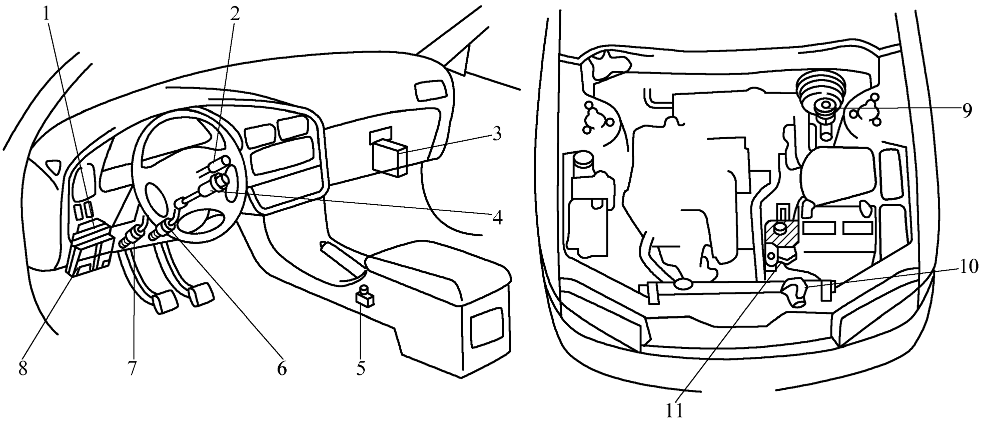


Fig. 4-7-1 The parts of cruise control system and their location

1—terminal box No. 1 2—ignition switch 3—cruise control system electrical control elements 4—cruise control switch 5—parking brake switch 6—parking light switch 7—clutch switch 8—diagnostic communication link 9—brake fluid level warning light switch 10—neutral drive switch 11—cruise control actuator

based on driveshaft rotations and used a solenoid to vary throttle position as needed.

The driver must bring the car up to speed manually and use a button to set the cruise control system to the current speed. The cruise control system takes its speed signal from a rotating driveshaft, speedometer cable, speed sensor (found on the wheels) or from the engine's RPM. Most systems do not allow the use of the cruise control system below a certain speed (normally 55km/h) to discourage use in city driving. The car will maintain that speed by pulling the throttle cable with a solenoid or a vacuum driven servomechanism.

Most systems can be turned off both explicitly and automatically, when the driver hits the brake or clutch. Cruise control system often includes a memory feature to resume the set speed after braking and a coast feature to reset the speed lower without braking. When the cruise control system is in effect, the throttle can still be used to accelerate the car, but once the accelerator is released the car will then slow down until it reaches the previously set speed. See Fig. 4-7-2.

Some modern vehicles have adaptive cruise control (ACC) systems. These use either a radar or laser setup to allow the vehicle keep pace with the car it is following, decelerate when closing in the vehicle in front and accelerate again to the preset speed when traffic allows. Some systems also feature forward collision warning systems, which warn the driver if a vehicle in front gets too close. See Fig. 4-7-3.

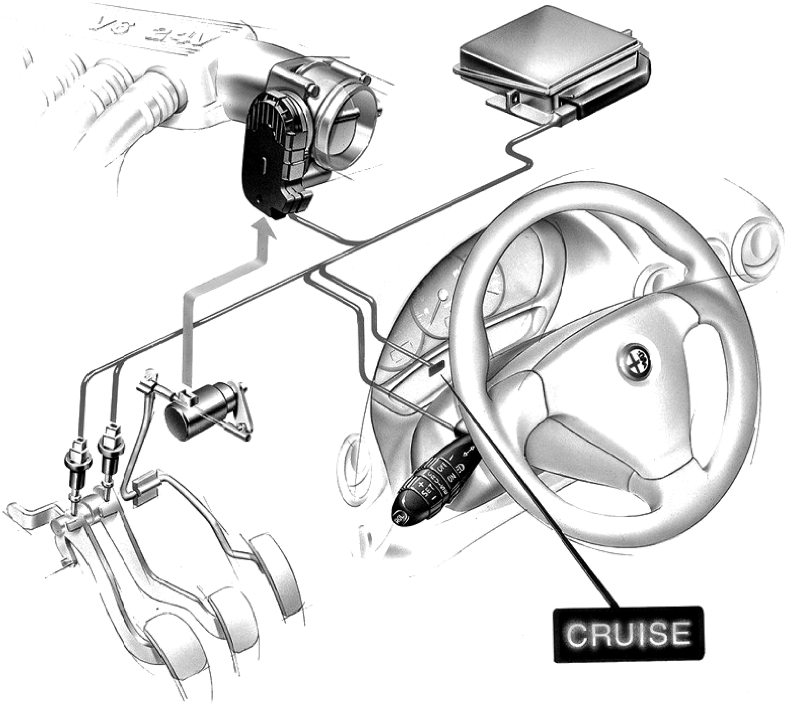


Fig. 4-7-2 The cruise of Alfa-Romeo

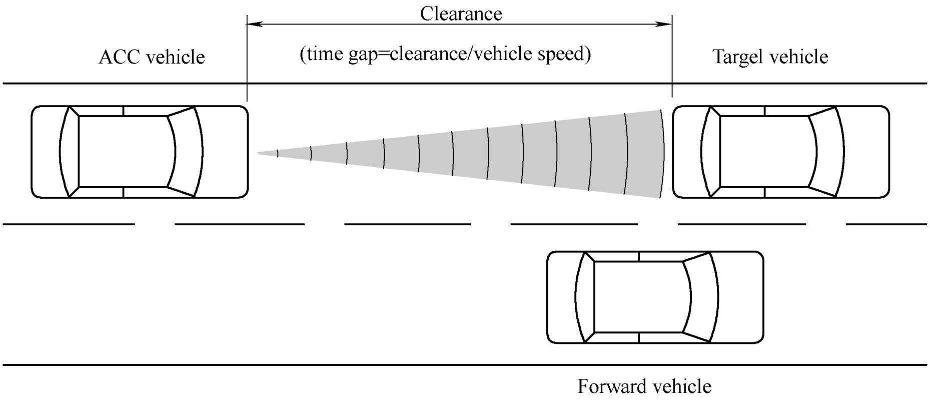


Fig. 4-7-3 The principle of adaptive cruise control system

New Words and Expressions

cruise	n. /vi.	巡游，巡航

throttle	n.	节气门
driveshaft	n.	传动轴
button	n.	按钮
speedometer	n.	速度表
vacuum	n.	真空
servomechanism	n.	伺服机构
coast	n.	滑行
accelerator	n.	加速器，加速踏板
radar	n.	雷达，无线电探向和测距
laser	n.	激光器
adaptive	adj.	自适应的，适合的
cruise control		巡航控制
throttle position		节气门位置
adaptive cruise control(ACC)		自适应巡航控制

Exercises

Ⅰ. Answer the following questions according to the text.

1. What does cruise control sometimes call?
2. What does cruise control work?

Ⅱ. Translate the following passage into Chinese.

Some modem vehicles have adaptive cruise control(ACC)systems. These use either a radar or laser setup to allow the vehicle keep pace with the car it is following, slow when closing in on the vehicle in front and accelerating again to the preset speed when traffic allows. Some systems also feature forward collision warning systems, which warn the driver if a vehicle in front gets too close.

Ⅲ. Translate the following phrases into English.

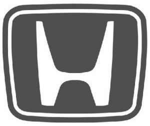
1. cruise control system ____________________
2. adaptive cruise control(ACC) ____________________
3. logic probe ____________________
4. accelerator pedal ____________________
5. throttle position ____________________
6. transmission speed sensor ____________________
7. cruise control module ____________________
8. cruise control switch ____________________
9. vehicle speed sensor ____________________

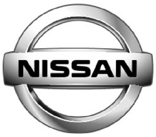
Ⅳ. Translate the following names of cars into Chinese.

1. Lamborghini ______________ 2. Bugatti ______________
3. Alf-Romeo ______________ 4. Lada ______________
5. Holden ______________ 6. Polonez ______________
7. Peugeot ______________ 8. Renault ______________
9. Venturi ______________ 10. Citroen ______________

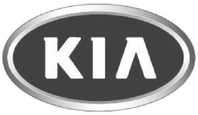
Ⅴ. The followings are some expressions for the famous brands. Match the following brands in Column A with their Chinese equivalents in Column B.

Column A

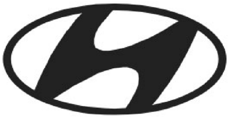

1. __________

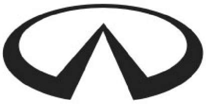


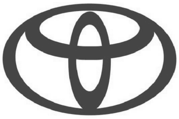
2. __________

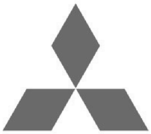


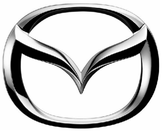
3. __________

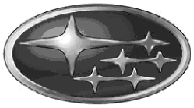

4. __________

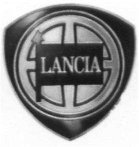

5. __________


6. __________


7. __________


8. __________


9. __________



10. __________

Column B

A. Mitsubishi 三菱 B. Mazda 马自达 C. Infiniti 英菲尼迪
D. Hyumdai 现代 E. Honda 本田 F. Kia 起亚
G. Lancia 蓝旗亚 H. Nissan 日产 I. Subaru 斯巴鲁
J. Toyota 丰田

Appendixes

Appendix A　The Names of Cars

German　德国

Mercedes-Benz			梅赛德斯—奔驰
BMW			宝马
Audi			奥迪
	A4	A4	
	A6	A6	
	A8	A8	
	Quattro	卡特罗	
	TT	TT	
Volkswagen			大众
	Bora	宝来	
	Lupo	路波	
	Polo	波罗	
	Golf	高尔夫	
	Passat	帕萨特	
	New Beetle	新甲壳虫	
	Sharan	夏朗	
Grace			格拉塞
Opel			欧宝
	Omega	欧美佳	
	Astra	雅特	
	Vectra	威达	
	Zafira	赛飞利	
Porsche			保时捷
Neoplan			尼奥普兰

America　美国

General Motor(GM)			通用
Chevrolet			雪佛兰
	Blazer	开拓者	
	Cavalier	骑士	
	Corsica	科西佳	
	Lumina	鲁米娜	
	S10	S10 皮卡	
	Suburban	郊区	
Buick			别克
	Centure	世纪	
	LeSabre	马刀	
	Park Avenue	林荫大道	
	Reatta	瑞塔	
	Regal	豪华	
	Riviera	里维埃拉	
	Roadmaster	路霸	
	Skylark	云雀	
	Deville	帝威	
	Eldorado	黄金国	
	Escalade	攀登	
	Fleetwood	佛利特伍德	
	Sevile	赛威	
Cadillac			凯迪拉克
Pontiac			庞蒂克
	Firebird	火鸟	
	Sunbird	太阳鸟	
	Sunfire	太阳火	
Generat			上将
Saturn			土星
Phoenix			凤凰
Oldsmobile			奥兹莫比尔
Chrysler			克莱斯勒
	Concorde	协和	

	Fifth Avenue	第五大道	
	Impeial	帝王	
	New Yorker	纽约人	
	PT Cruiser	PT 巡游者	
Dodge			道奇
	Avenger	复仇者	
	Caravan	捷龙	
	Imprepid	无畏	
	Neon	彩虹	
	Ram	公羊	
	Stratus	层云	
Viper			蝰蛇
Eagle			鹰
Plymouth			普利茅斯
Ford			福特
	Crown Victoria	皇冠维多利亚	
	Escort	护卫	
	Explorer	探险者	
	Focus	福克斯	
	Mondeo	蒙迪欧	
	Mustang	野马	
	Taurus	金牛座	
	Tempo	天霸	
	Windstar	稳达	
Cougar			美洲狮
King			君主
Cobra			眼镜蛇
Lincoln			林肯
	Contineta1	大陆	
	Mark Ⅷ	马克八	
	Navigator	航海家	
	Town Car	城市	
Thunderbird			雷鸟
Mercury			水星
Panoz			帕诺兹

Mack			麦克
Jeep			吉普
	Cherokee	切诺基	
	Grand Cherokee	大切诺基	
	Wrangler	牧马人	
Land Rover			路虎
	Defender	卫士	
	Discovery	发现	
	Freelander	自由人	
	Rande-Rover	揽胜	
Hummer			悍马

Japan　日本

Toyota			丰田
	Crown	皇冠	
	Corolla	花冠	
	Avalon	亚洲龙	
	Camry	佳美	
	Celica	塞里卡	
	Century	世纪	
	Coaster	考斯特	
	Cressida	克雷西达	
	Hiace	海狮	
	Hilux	海拉克斯	
	Land Cruiser	陆地巡洋舰	
	Previa	大霸王	
	Tercel	特赛尔	
Lexus			雷克萨斯
Nissan			日产
	Bluebird	蓝鸟	
	Cedric	公爵	
	Cefiro	风度	
	Cherry	樱花	
	Cima	西玛	
	Civilian	碧莲	

	Laurel	桂冠	
	Maxima	千里马	
	Pathfinder	探路者	
	Patrol	途乐	
	Pickup	皮卡	
	Sunny	阳光	
	Jurvan	佳奔	
Infiniti			英菲尼迪
Honda			本田
	CR-V	思威	
	Stream	时韵	
	Legend	传奇(里程)	
	Accord	雅阁	
	Civic	思域	
	Integra	英特格拉	
	Odyssey	奥德赛	
Acura			讴歌
Mitsubishi			三菱
	Eclipse	日蚀	
	Diamante	德姆特	
	Galant	戈蓝	
	Lancer	蓝瑟	
	Mirage	海市蜃楼	
	Montero	蒙特罗	
	Pajero	帕杰罗	
	Sigma	西格玛	
	Spacewagon	太空	
Mazda			马自达
Isuzu			五十铃
Daihatsu			大发
Subaru			斯巴鲁
Suzuki			铃木
Hino			日野
Tommykaira			龟牌
Autozam			奥图兰姆

Efini	仪飞尼
Eunos	优娜斯
Yelong	裕隆

France　法国

Peugeot	标致
Citroen	雪铁龙
Renault	雷诺
Venturi	文图瑞

Italy　意大利

Fiat	菲亚特
Ferrari	法拉利
Iveco	依维柯
Maserati	玛莎拉蒂
Lamborghini	兰博基尼
Isorvolta	伊索
Lancia	蓝旗亚
Pininfarina	平尼法尼那
Abarth	阿巴斯
Bugatti	布加迪
Piaggio	比亚乔
Alfa-Romeo	阿尔法·罗密欧

Britain　英国

Rolls-Royce	劳斯莱斯
Jaguar	捷豹
Mini	迷你
Lotus	莲花
Leyland	利兰
Fooder	福登
Triumph	凯旋
Marcos	玛柯斯
Bentley	宾利
Rover	罗孚

MG			名爵
Aston Martin			阿斯顿·马丁
Morgan			摩根
Vauxhall			伏克斯豪尔

Korea 韩国

Hyundai			现代
	Accent	雅绅特	
	Centennial	百年	
	Sante Fe	桑塔菲	
	Sonata	索纳塔	
Kia			起亚
	Besta	贝斯塔	
	Pride	普莱特	
	Carnival	嘉年华	
	Sephia	塞飞亚	
	Sportage	狮跑	
Daewoo			大宇
	Prelude	序曲	
	Lanos	蓝龙	
	Leganza	典雅	
	Lemans	莱门斯	
	Matiz	马蒂兹	
	Nubira	旅行家	
	Prince	普林斯(王子)	
	Racer	雷瑟(赛手)	
	Super-salon	超级沙龙	
Ssangyong			双龙

Sweden 瑞典

Volvo			沃尔沃
Saab			萨博
Scania			斯堪尼亚

Spain　西班牙

SEAT	西特
Picasso	毕加索

Czech　捷克

Skoda			斯柯达
	Fabia	法比亚	
	Octivia	欧亚	

Switzerland　瑞士

Smart	精灵

Romania　罗马尼亚

Dacia	达西亚

Malaysia　马来西亚

Proton	宝腾

Poland　波兰

Polonez	波罗乃兹

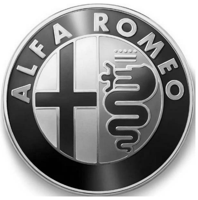
Russia　俄罗斯

Lada	拉达

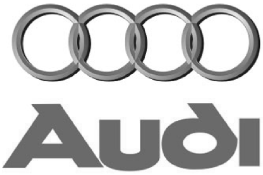
Australia　澳大利亚

Holden	霍尔顿

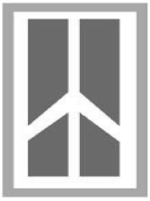
Appendix B　Vehicle Marks



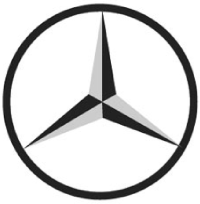
Alfa-Romeo
阿尔法·罗密欧



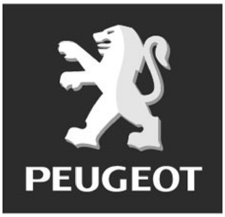
Audi
奥迪



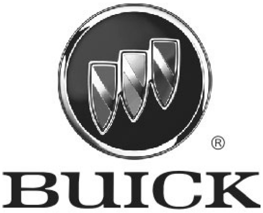
Olds
奥兹



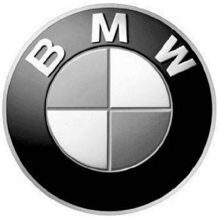
Mercedes-Benz
梅赛德斯-奔驰



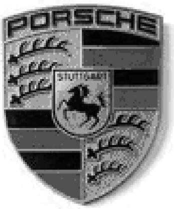
Peugeot
标致



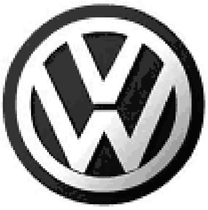
Buick
别克



BMW
宝马



Porsche
保时捷



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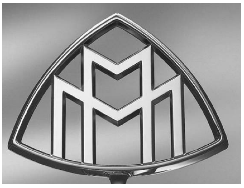
大众



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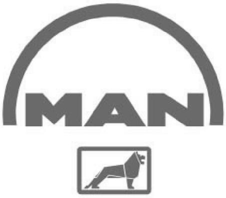
迈巴赫



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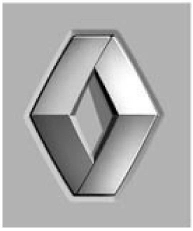

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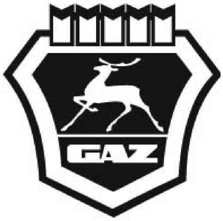
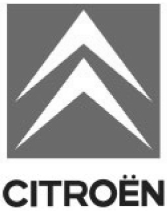
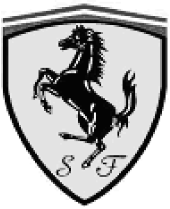


Gaz
嘎斯



Citroen
雪铁龙



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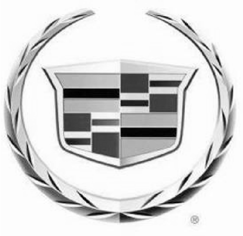
法拉利



Cadillac
凯迪拉克

Chrysler
克莱斯勒

Dodge
道奇

Lamborghini
兰博基尼

Rolls-Royce
劳斯莱斯

Maserati
玛莎拉蒂

Opel
欧宝

Pontiac
庞蒂克

Saab
萨博

Koenigsegg
幽灵

Cougar
美洲狮

Skoda
斯柯达

GM
通用

SEAT
西特

Mustang
野马

Fiat
菲亚特

President
日产总统

Mini
迷你

Jaguar
捷豹

Chevrolet
雪佛兰

Land Rover
路虎

Lister
利斯特

Lotus
莲花

MG
名爵

Rover
罗孚

Plymouth
普利茅斯

Daewoo
大宇

Samsung
三星

Ssangyyong
双龙

Honda
本田

Daihatsu
大发

Toyota
丰田

Mazda
马自达

Nissan
日产

Suzuki
铃木

Mitsubishi
三菱

Subaru
斯巴鲁

Hyundai
现代

Lexus
雷克萨斯

Venturi
文瑞图

Ford
福特

Morgan
摩根

Kia
起亚

Infiniti
英菲尼迪

Mercury
水星

Oldsmobile
奥兹莫比尔

Viper
蝰蛇

Eagle
鹰

Saturn
土星

Panoz
帕诺兹

Mack
麦克

Acura
讴歌

Isuzu
五十铃

Hino
日野

Tommykaira
龟牌

Piaggio
比亚乔

Lancia
蓝旗亚

Bugatti
布加迪

Abarth
阿巴斯

Leyland
利兰

Marcos
玛柯斯

Bentley
宾利

Volvo
沃尔沃

Aston Martin
阿斯顿·马丁

Lada
拉达

Iveco
依维柯

Jeep
吉普

Dacia
达西亚

Scania
斯堪尼亚

Proton
宝腾

Vauxhall
伏克斯豪尔

Polonez
波罗乃兹

GMC
吉姆西

Smart
精灵

Corvetter
克尔维特

Aro
阿罗

Pegaso
毕加索

Panther
黑豹

Triumph
凯旋

Crown
皇冠

Pininfarina
平尼法尼那

Steyr
斯太尔

Eudos
马自达俊朗

Austin Rover
罗孚奥斯丁

Bertone
博通

Daimler
戴姆勒

AC
爱希

Holoden
霍顿

Spyker
世爵

昌河汽车

CHANA
长安汽车

中华汽车

长丰猎豹

SMA
上海华普

东风风行

SOUEAST
东南汽车

红旗
一汽红旗

JIN BEI
金杯

陆丰汽车

奇瑞汽车

荣威

中兴汽车

BJC

北汽

保定大迪

海马汽车

福田汽车

Appendix C　English Abbreviations for Automobile

Abbreviations	**English Meaning**	**中文意思**
AAP	Auxiliary Accelerator pump	辅助加速器泵
AAP	Ambient Absolute Pressure	外界绝对压力
AAS	Automatic Adjusting Suspension	自动调节悬架
AB	Air Bag	气囊
AB	Air Bleed	放气
ABDC	After Bottom Dead Center	下止点后
ABS	Anti-lock Brake System	防抱死制动系统
ABS	Anti-skid Brake System	防滑制动系统
ABRS	Air Bag Restraint System	安全气囊系统
ABV	Air Bypass Valve	空气旁通阀
ABV	Anti-backfire Valve	防回火阀
A/C	Air Conditioning	空调
A/CL	Air Cleaner	空气滤清器
AC	Automatic Control	自动控制
AC	Automatic Clutch	自动离合器
AC	Air Compressor	空气压缩机
ACC	Accessory	附属设备
ACC	Air Conditioning Clutch	空调离合器
ACCS	Air Conditioning Cycling Switch	空调循环开关
ACRS	Air Cushion Restraint System	(乘员)安全气囊式约束装置
ACS	Air Conditioning System	空调系统
ACG	Alternating Current Generator	交流发电机
ACT	Air Charge Temperature	进气温度
ACTS	Air Charge Temperature Sensor	进气温度传感器
ADM	Advance Module	点火提前角控制模块
AEC	Automotive Emission Control	汽车排放控制
A/F	Air Fuel Ratio	空燃比
AFE	Automobile Fuel Economy	汽车燃油经济性
AFS	Air Flow Sensor	空气流量传感器
AIS	Air Injection System	空气喷射系统
ALC	Automatic Level Control	车身自动调平控制
ALT	Alternator	交流发电机

ANT	Antenna	天线
AP	Accelerator Pedal	加速踏板
APP	Accelerator Pedal Position	加速踏板位置
APS	Absolute Pressure Sensor	绝对压力传感器
ASCD	Auto Speed Control Device	自动速度调节装置
ASIS	Abort Sensing and Implementation System	紧急故障传感及处理系统
ASR	Automatic Slip Regulation	侧滑自动控制
ASSY	Assembly	总成
AT/ATM	Automatic Transmission	自动变速器
A/T	Automatic Transaxle	自动驱动桥
ATA	Anti-thief Alarm	防盗报警
ATDC	After Top Dead Center	上止点后
ATF	Automatic Transmission Fluid	自动变速器油液
ATS	Air Temperature Sensor	空气温度传感器
AWD	All Wheel Drive	全轮驱动
AWS	All Wheel Steering	全轮转向

BA	Brake Assist	辅助制动装置
BAS	Brake Assisted System	制动助力系统
BAT	Battery	蓄电池
BAV	Bleed Air Valve	泄气阀
BCM	Body Control Module	车身控制模块
BDC	Bottom Dead Center	下止点
B +	Battery Positive Voltage	蓄电池正极电压
BLS	Back-up Light Switch	倒车灯开关
BMC	Brake Master Cylinder	制动主缸
BP	Best Power	最佳功率
BPA	Bypass Air	旁通空气
BPM	Brake Pressure Modulator	制动压力调节器
BPMV	Brake Pressure Modulating Valve	制动压力调节阀
BSFC	Brake Specific Fuel Consumption	制动油耗率，单位制动油耗量
BTR	Brake Transmission Ratio	制动传动比
BV	By pass Valve	旁通阀

CAC	Charge Air Cooler	进气冷却器
CAM	Computer Aided Manufacturing	计算机辅助制造

CAS	Clear Air System	净化空气系统
CB	Circuit Breaker	断路器
CCM	Central Control Module	中央控制模块
CCM	Cruise Control Module	巡航控制模块
CCS	Cruise Control Switch	巡航控制开关
CCS	Combustion Control System	燃油控制系统
CES	Clutch Engaged Switch	离合器啮合开关
CDI	Capacitive Discharge Ignition	电容放电式点火
CF	Cooling Fan	冷却风扇
CFI	Central Fuel Injection	中央燃油喷射
CFI	Continuous Fuel Injection	连续燃油喷射
CI	Circuit Ignition	线圈式点火
CI	Compression Ignition	压燃
CID	Cylinder Identification	气缸识别
CIL	Clear Indicating Light	消除故障码指示灯
CIS	Conventional Ignition System	传统点火系统
CKPS	Crankshaft Position Sensor	曲轴位置传感器
CMPS	Camshaft Position Sensor	凸轮轴位置传感器
CPC	Clutch Pressure Control	离合器压力控制
CPM	Cycle Per Minute	每分钟转数
CPP	Clutch Pedal Position	离合器踏板位置
CPS	Camshaft Position Sensor	凸轮轴位置传感器
CPS	Crankshaft Position Sensor	曲轴位置传感器
CPU	Central Processing Unit	中央处理器
CR	Compression Ratio	压缩比
CRS	Child Restraint System	儿童安全保护系统
CSI	Cold Start Injector	冷起动喷油器
CSS	Cruise Set Speed	巡航设定速度
CTS	Coolant Temperature Sensor	冷却液温度传感器
CTP	Closed Throttle Position	节气门关闭位置
CVT	Continuously Variable Transmission	无级变速器
CYL	Cylinder	气缸
CYP	Cylinder Position	气缸位置
DC	Direct Current	直流电
DEF	Defogger	除雾器

DFI	Direct Fuel Injection	直接燃油喷射
DFI	Direct-fire Ignition	直接点火
DI	Distributor Ignition	分电器点火
DIS	Distribution Ignition System	分电盘式点火系统
DID	Direct Injection Diesel	柴油直接喷射
DIM	Dash Integrated Module	仪表板集成模块
DLC	Data Link Connector	诊断传输接头
DLS	Distributorless Ignition System	无分电器式点火系统
DOHC	Double Overhead Camshaft	顶置双凸轮轴
DMM	Digital Multimeter	数字式万用表
DS	Detonation Sensor	爆燃传感器
DTC	Diagnostic Trouble Code	诊断故障码
DTM	Diagnostic Test Mode	诊断测试模式

EAT	Electronic Automatic Transmission	电控自动变速器
EACV	Electric Air Control Valve	电动空气调节阀
ECA	Electronic Control Assembly	电子控制总成
ECC	Electronic Chassis Control	电子底盘控制
ECI	Electronic Controlled Ignition	电子控制点火
ECL	Engine Coolant Level	发动机冷却液液面
ECM	Engine Control Module	发动机控制模块
ECS	Engine Control System	发动机控制系统
ECT	Electronic Control Transmission	电控变速器
ECU	Electronic Control Unit	电子控制单元
EFI	Electronic Fuel Injection	电子燃油喷射
EGR	Exhaust Gas Recirculation	废气再循环
EI	Electronic Ignition	电子点火
EIS	Electronic Ignition System	电子点火系统
EIN	Engine Identification Number	发动机识别号码
EMD	Engine Monitor Display	发动机监控显示器
EPA	Environmental Protection Agency	(美国)环保署
EPS	Electronic Power Steering	电子动力转向
ESAC	Electronic Spark Advance Control	电子点火提前控制
ESC	Electronic Spark Control	电子点火控制器
ESP	Electronic Stability Program	电子稳定程序
ESS	Engine Speed Sensor	发动机转速传感器

ETC	Electronic Temperature Control	电子温度控制
F/A	Fuel-Air Ratio	燃油空气混合比
FC	Fuel Consumption	燃油消耗量
F/F	Front Engine/Front Wheel Drive	前置发动机/前轮驱动
FF	Front Engine Front Drive	前置发动机前轮驱动
FL	Fusible Links	熔断器
FLP	Fault Location Panel	故障诊断仪表板
FR	Front Engine Rear Drive	前置发动机后轮驱动
FWB	Front Wheel Brake	前轮制动
FWD	Front Wheel Drive	前轮驱动
GAS. F	Gas Filter	汽油滤清器
GM	General Motors Corporation	(美国)通用汽车公司
GND	Ground	搭铁
GP	Gear Ratio	传动比
GPS	Global Positioning System	全球定位系统
GSS	Gear Select Switch	档位选择开关
GW	Gross Weight	总重量
HARN	Harness	线束，配线
HHT	Hand-Held Tester	手持式检测仪
HP	Hydraulic Pump	液压泵
HTC	Hydraulic Torque Converter	液力变矩器
HSO	High Speed Output	高速输出装置
IAC	Idle Air Control	怠速空气控制
IACV	Idle Air Control Valve	怠速控制阀
IAF	International Automobile Federation	国际汽车联合会
IATS	Intake Air Temperature Sensor	进气温度传感器
ICM	Ignition Control Module	点火控制模块
ID	Identification	辨认，识别
IFS	Independent Front Suspension	独立式前悬架
IMPS	Intake Manifold Pressure Sensor	进气歧管压力传感器
IRS	Independent Rear Suspension	后独立悬架
ISC	Idle Speed Control	怠速速度控制

ISO	International Standard Organization	国际标准组织
IT	Ignition Timing	点火正时
ITCS	Ignition Timing Control System	点火正时控制系统
ITDC	Ignition Top Dead Center	点火上止点

KS	Knock Sensor	爆燃传感器

LCR	Low Compression Ratio	低压缩比
LDC	Lower Dead Center	下止点
LEV	Low Emission Vehicle	低排放汽车
LED	Light Emitting Diode	发光二极管
L-4	In-Line Four Cylinder(Engine)	直列式四气缸(发动机)
LLC	Long-life Coolant	长效冷却液
LO	Lubricating Oil	润滑油
LOP	Lubricating Oil Pump	润滑油泵
LS	Leaf Spring	钢板弹簧
LSD	Limited Slip Differential	防滑差速器

MAP	Manifold Absolute Pressure	进气歧管绝对压力
MAF	Mass Air Flow	空气流量计
MAFS	Mass Air Flow Sensor	质量型空气流量传感器
MAPS	Manifold Absolute Pressure Sensor	歧管绝对压力传感器
MAT	Manifold Air Temperature	歧管空气温度
MCS	Mixture Control Solenoid	混合气控制电磁线圈
MIL	Malfunction Indicator Lamp	故障指示灯
MPI	Multi-point Fuel Injection	多点燃油喷射
M/S	Manual Steering	手(机械式)转向
M/T	Manual Transmission	手动变速器

N/C	Neutral Start Switch/Clutch Switch	空档起动开关/离合器开关
NDS	Neutral Drive Switch	空档驱动开关
NPS	Neutral Pressure Switch	空档压力开关
N/V	Ratio of Engine RPM to Vehicle Speed	发动机转速与车速之比
NSS	Navigation Satellite System	卫星导航系统

OBD Ⅱ	On-Board Diagnostic Ⅱ	第二代车载诊断系统

OCV	Oil Control Calve	机油控制阀
ODI	Oil Drain Intervals	换油期限
ODPSK	Oil Dipstick	（机）油尺，量油尺
OEM	Original Equipment Manufacturer	原装设备生产厂
OFL	Oil Filter	机油滤清器
OHC	Overhead Camshaft	顶置凸轮轴
OHV	Overhead Valve	顶置气门
OSHA	Occupational Safety and Health Act	职业安全与卫生条例
OPS	Oil Pressure Sensor	机油压力传感器
PCM	Power Train Control Module	动力系统控制模块
PCM	Power Control Module	动力控制模块
PCV	Positive Crankcase Ventilation	曲轴箱强制通风
PFI	Port Fuel Injection	进气口燃油喷射
PMR	Pump Motor Relay	油泵电动机继电器
PS	Power Steering	动力转向
PSC	Power Steering Control	动力转向控制
P/W	Power Window	电动车窗
RABS	Rear Anti-lock Brake System	后防抱死制动系统
RAM	Random Access Memory	随机存储器
RAR	Repair As Required	视情修理
RHD	Right Handle Drive	右侧驾驶
RM	Relay Module	继电器模块
RPM	Revolution Per Minute	每分钟转数
RWD	Rear Wheel Drive	后轮驱动
SAE	Society of Automotive Engineers	（美国）汽车工程师学会
SAEC	Society of Automotive Engineers of China	中国汽车工程师学会
SOHC	Single Overhead Camshaft	顶置单凸轮轴
SPEC	Specification	规格
SPI	Single Point Injection	单点喷射
S/R	Sun Roof	遮阳板
SRS	Supplemental Restraint System	安全气囊
4S	Sale, Spare, Service, Survey	汽车销售、配件供应、维修服务、技术信息反馈（4S 店）

SUV	Sport Utility Vehicle	运动型多用途车
TA	Intake Air Temperature Sensor	进气温度传感器
TAP	Throttle-Alternator Position	节气门开度位置
TB	Throttle Body	节气门体
TBI	Throttle Body Injection	节气门体喷射
TC	Turbocharger	涡轮增压器
TCC	Torque Converter Clutch	液力变矩器离合器
TCS	Transmission Control Switch	变速器控制开关
TCW	Two-Cycle Water-cooled	二冲程水冷发动机
TDC	Top Dead Center	上止点
TDCL	Test Diagnostic Communication Link	自诊断接头
TDCS	Top Dead Center Sensor	上止点传感器
T/N	Tool Number	工具编号
TPS	Throttle Position Sensor	节气门位置传感器
TSB	Technical Service Bulletins	技术维修通报
TS	Temperature Sensor	温度传感器
TS	Transmission Switch	变速器开关
TSS	Transmission Speed Sensor	变速器速度传感器
TTS	Transmission Temperature Sensor	变速器温度传感器
TWC	Three Way Converter	三元催化转换器
VAPS	Variable Assist Power Steering	可变式动力转向
VASC	Vacuum Advance Spark Control	真空提前点火控制
VATC	Vehicle Anti-thief System	车辆防盗系统
VC	Valve Control	气门控制
VCM	Vehicle Control Module	车辆控制模块
VCRM	Variable Control Relay Module	可调控制继电器模块
VCV	Vacuum Control Valve	真空控制阀
VEI	Vehicle Evaluation and Improvement	车辆鉴定与改进
VIN	Vehicle Identification Number	车辆识别号码
VSA	Vehicle Stability Assist	车辆稳定性控制装置
VSS	Vehicle Speed Sensor	车速传感器
VSV	Vacuum Solenoid Valve	真空电磁阀
VTC	Valve Timing Control	气门正时控制
VTV	Vacuum Transmitting Valve	真空转向阀

VVT	Variable Valve Timing	可变气门正时
WMI	World Manufacturer Identifier	世界车辆制造厂识别
WOT	Wide Open Throttle	节气门全开
WOT	Wide Open Throttle Switch	节气门全开开关
WSS	Wheel Speed Sensor	轮速传感器
WV	Weight of entire Vehicle	整车重量，车辆总重
ZEV	Zero Emission Vehicle	零污染排放车辆

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